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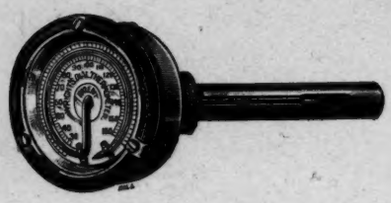

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EDITORIAL NOTES.

Gas Light and Coke Company's Results in the Third Half Year of War.

WERE it not for the facts that the consumers are paying a higher price for their gas, that the proprietors are suffering a reduction of dividend, and the employee co-partners a diminution of their bonus as well as dividend as stockholders, there would be unmitigated gratification by all concerned in the Gas Light and Coke Company over the financial results of the third half-year's working under war conditions. The Company are to-day in a stronger financial position than they have been at any time since normal conditions were wholly superseded by chaotic and strange ones, which have been and are of a heavy and severe order for all gas undertakings, and must have stood at the maximum in these characteristics for the largest undertaking. In connection with the Gas Light Company, there has been in pre-war years a great deal of thankfulness expressed over the rehabilitation of its fortunes under the governorship of Sir Corbet Woodall, D.Sc.; but if ever the Company required a strong head, with an able Board and a skilful staff to support him, it has been during this war. The fact speaks loudly that, after eighteen months of it, the accounts show the Company standing with the minimum of injury, and fortifying their position to meet, it is greatly feared, still worse conditions before improved ones set in with the return of peace.

The Governor will next Friday be able to illustrate all this better than we from the outside can possibly do. There is, however, no difficulty in drawing conclusions from the salient facts presented by the accounts; the trouble is to show by contrast what has happened with any degree of precision in view of the altogether different conditions under which working has been proceding, even compared with the second half of 1914. In that half year, there was one month pursuing its normal peace course, though rumours were busy, and causing uneasiness, as to the possibility of this country being involved in war. There were five months of war. In three months of the half year, the price of gas was 2s. 6d. per 1000 cubic feet; and in the other three months, 2s. 8d. But throughout the past six months 3s. has ruled. Coal prices and rates of freight have been higher; the residuals markets altogether changed their aspects; labour is costing more; and business has been further restricted "by order," with the view of shielding London during the hours of night. There is nothing consistent between the two half years to enable contrast to be made on level terms. But the facts stand out clearly that, despite the total expenditure on revenue account having, compared with the second half of 1914, risen by £331,029, to £2,150,193, the total income being £2,754,507 (an addition of £485,833), the balance transferred to net revenue account is £604,313, which is greater by £154,803. Providing for fixed charges, placing £5000 to the redemption fund, and £10,000 to the special purposes fund (which appropriation was missed in the second half of 1914), the profit balance is £353,427, compared with £230,892, or £122,535 more. With the amount brought from the previous half year, £436,058, there is an available balance of £789,485, which is better by £23,279. But the dividend under the sliding-scale this half year is £4 4s. per cent., as against £4 13s. 4d. twelve months ago; and the former will require £342,870, as compared with the £381,668 needed for the latter. In the result, the amount to be carried forward to the next account is £446,614, which is higher by £62,076 than at this time last year. This view of the stronger position has to be supplemented by an inspection of the spendings and writings off. We see that the charges for repairs, maintenance, and renewals are up to the level of normal times, and higher than in the second half of 1914. In the capital account, it is also observed, plant, meters, and stoves have been depreciated by £128,315, while the additional capital expenditure is £71,897. Investments, too, have been written-down by £24,897. These are matters to be taken into account when considering the financial position; and, so considering them, the proprietors will see that their concern is being well-safeguarded, and the consumers that they are being protected, so far as can be foreseen, against a further advance in price.

The darkest spot in the accounts is the item of coal. Apart from its higher price, the Company have, through torpedoes and mines, had some serious losses in colliers, which, however well covered by insurance, means that, to fill the gap between tonnage owned and tonnage required, the market rates of freight have had to be paid. Coal cost £887,263, or no less than £227,739 more than in the second half of 1914, though the quantity carbonized (829,040 tons) was greater by only 12,388 tons. A more striking comparison is that, although 120,099 tons of coal less were carbonized than in the December half of 1913, the cost was higher by £104,656. The expenditure on oil was £115,694, or £14,847 greater; and on coke and breeze, £59,610, or an advance of £14,765—these higher figures notwithstanding that, as will be seen presently, there was somewhat less carburetted water gas made. The quantity of oil used was 8,070,073 gallons—a diminution of 234,452 gallons. However, from these costly raw materials, there were made 13,856,399,000 cubic feet of gas, or 43,075,000 cubic feet more than in the December half of 1914—the division between the coal gas and the carburetted water gas being 10,604,415,000 cubic feet, and 3,251,984,000 cubic feet respectively. In the second half of 1914, the total make of gas was 13,813,324,000 cubic feet, of which 10,142,459,000 were coal gas, and 3,670,865,000 carburetted water gas. From these figures, it will be seen that 418,881,000 cubic feet less carburetted water gas were made last half year, but 461,956,000 more coal gas. We may digress for a moment to compliment the manufacturing department on the yield of 12,791 cubic feet of gas per ton, compared with 12,419 cubic feet in the December half of 1914, and 12,306 cubic feet in the second half of 1913.

As a partial set-off to the very remarkable figures as to the cost of raw materials, the residual products returned £600,061, or £202,016 more than in the second half of 1914, and £8571 more than in the corresponding period of 1913, although so much more coal was carbonized in the last-named period. The total returns for residuals in the past six months, although not the quantities sold, and therefore not the prices, show an extraordinary coincidence with those for the December half of 1913, as will be observed by the figures in parentheses. Coke produced £369,099, or £125,607 more than in the second half of 1914 (1913, £362,309); breeze £27,900, or £16,877 more (1913, £26,500); tar and tar products, £82,760, or £14,303 more (1913, £89,770); ammoniacal liquor and sulphate of ammonia £120,301, or £45,228 more (1913, £112,910). In passing, it is interesting to observe that there were in store at Dec. 31, 50,682 tons of coke, as compared with 11,658 tons brought into the half year; 61,694 tons at December, 1914; and 92,222 tons at December, 1913. The part that residual products have taken in ameliorating the situation can be seen by a very few figures. The cost of materials for the manufacture of gas was more by £257,351 than in the second half of 1914, and more by £190,841 than in the corresponding period of 1913, notwithstanding the larger business then done. But deducting the income from residuals (£600,061) from the total cost of raw materials (£1,062,567), we have last half year a net cost of £462,506, compared with £407,171 in the second half of 1914, and £280,236 in the December half of 1913, which net costs respectively represent 8·01d., 7·07d., and 4·63d. per 1000 cubic feet. Of course, the differences in these figures are not by any means the only higher costs that the Company have had to incur, as a comparative examination of the accounts discloses. It may be incidentally mentioned here that the Company had coal in store at Dec. 31 amounting

to 267,772 tons, which is close to the quantity in store on Dec. 31, 1913—viz., 265,692 tons. The amount in store on Dec. 31, 1914, was 138,839 tons; so that the position in regard to the coal reserves is considerably better than twelve months ago.

The sales of gas present some interesting features. The total amount sold was 12,905,757,000 cubic feet, or more by 178,716,000 cubic feet than in the December half of 1914, but 451,996,000 cubic feet less than in the corresponding period of 1913. It is very satisfactory to find that the private consumers (including shops), in using 12,662,931,000 cubic feet, took more by 314,875,000 cubic feet than in the second half of 1914, and only short of the sales in the corresponding period of 1913 by 224,469,000 cubic feet. But the further restrictions of lighting in the streets resulted in 136,159,000 cubic feet less being consumed in this direction than in the December half year of 1914, and 227,527,000 cubic feet less than in the same period of 1913. From these figures, it will be remarked that the reduction of 451,996,000 cubic feet in the gas sales as compared with the December half of 1913 is about equally divided between the private consumers and the public lighting—224,469,000 cubic feet in respect of the former, and 227,527,000 cubic feet in regard to the latter. The total receipts for gas (at the increased price) in the half year were £1,898,716, or £278,441 more than in the corresponding half of 1914. This increase is all due to private consumption and £2964 besides, seeing that the receipts from public lighting were down by this amount. As private lighting includes shop lighting, and as shop lighting has been compulsorily curtailed so much, the position is, in the circumstances of the times, far from being unsatisfactory. The satisfaction is enhanced by the continued enrolment of gas consumers. Last half year an additional 5367 consumers were placed on the books; and 31,044 gas fires and cookers were sold or let on hire. Further testimony as to expansion of the foundation of business is seen in the fact that the rental of meters, stoves, and fittings has increased by £11,377, to £249,721 since December, 1913—the rental for last half year being by £5466 higher than in the second half of the year 1914.

These are the salient features of the accounts. We will not run over the upward changes, compared with normal times or the second half of 1914, in the outgoings of the half year. They are found in substantial amount in several items on the expenditure side of the revenue account. The main feature for congratulation is that, under the heavily oppressive circumstances in which trading has proceeded, the financial position is so strikingly good.

Close Working in South London.

THE accounts of the South Metropolitan Gas Company clearly present the fact that the Chairman (Mr. Charles Carpenter, D.Sc.) and his fellow-Directors, in making their estimates in regard to the raising of the price of gas, though the factors were at the time hazy in the extreme, did not, in fixing upon 2s. 10d, take from the consumers a penny more per 1000 cubic feet than was necessary. What would be the cost of coal at the pithead was fairly well known; there was some amount of doubt as to the expense of transporting coal from the North to London; there was speculation as to whether or not there would be a further falling-off in gas consumption; the markets for residuals were uncertain as to the extent of their upward movements; and the degree of the effect of the shortage of labour, skilled and unskilled, was a source of anxiety, and, as has since been proved, this has materially hampered the Company in their operations. But, with all the ambiguity as to what might happen, the additional price of gas, helped by the partial compensation from residuals to the high price of coal and rates of freights (by the way, the report does not mention anything as to the Company's experience with their own steamers), enables the Directors to recommend the payment of a dividend at the sliding-scale rate of £4 8s. per cent. per annum, and to handle a surplus of £29,176, from which £10,000 has been allocated to the insurance fund (which was greatly depleted as the result of the coal strike), leaving £19,176 to increase to £23,968 the sum carried forward. This is a close result. Nevertheless, looking down the items on the expenditure side of the revenue account, save in regard to coal and two exceptional charges, they are approximately normal in amount. This can be shown by few figures. The total expenditure is £1,152,527, as compared with £885,634 in the corresponding half of 1914, or an increase of £266,893. Mainly due to coal and freights, the manufacturing charges (£829,668) are £232,894 more; the superannuation, sick, and accidents fund is up by about £10,000; and, in place of the item employees' reservists fund, £3207, of twelve months since, there is the charge for war bonus and war fund, £31,505, or £28,298 more. These named extra outgoings overlap the addition of £266,893 to the total expenditure; so that there is no need to traverse in detail the items to the debtor of the revenue account. Mentioning total expenditure, it may be at once pointed out that the sum of the income was £1,370,745, or £305,126 more than in the second half of 1914; and the balance to net revenue account is £218,218, or £38,233 more. In every way, it is seen that the Directors were justified in their estimates in relation to the raising of the price of gas.

The three prominent points of interest are therefore coal, residuals, and sales of gas. As to the increased costs of coal and freights, the Directors are philosophically resigned to the view that "it seems unlikely that any relief from "these burdens can be expected during the war." This view, expressed with a caution that leaves a loophole for improvement if something extraordinary should occur to promote it, is a pretty safe one. The cost of coal during the half year was £646,467, or £242,894 more than in the second half of 1914, though only 7016 tons more coal were used; and it is £180,378 more than in the December half of 1913, although 5061 tons less were carbonized. This close consumption of coal in the three half years with makes of gas widely different, appears to call for a little explanation. Some 552,492 tons of coal were required in the past half year to produce 6,783,474,000 cubic feet of gas; while, in the corresponding period of 1914, 545,476 tons produced 6,880,774,000 cubic feet of gas—the respective makes per ton being 12,278 cubic feet and 12,614 cubic feet. The explanation of this reduction of make per ton is probably shortage of labour, or maybe the quality of the coal—perhaps both; and, as likely as not, there is some other contributing cause. Despite what the Company are doing in the matter of toluol recovery, the official returns show that the gas is being maintained of the high quality that obtained prior to the war; and with the Company quality takes precedence of quantity. Reverting to the expenditure of £646,467 on coal, residuals yielding £397,177 bring the net cost of coal to £249,290 for 552,492 tons. The corresponding figures in the December half of 1914 were: Coal, £403,573, and residuals £237,318—giving a net cost of £166,255 for 545,476 tons. In the December half of 1913, the figures were: Coal, £466,089, and residuals, £328,985—making the net cost £137,104 for 557,553 tons of coal. These net costs work out per 1000 cubic feet of gas as follows: With a make last half year of 6,783,474,000 cubic feet, to 8·81d.; with a make of 6,880,774,000 cubic feet in the corresponding period of 1914, to 5·79d.; and with a make of 7,099,900,000 cubic feet in the second half of 1913, to 4·63d. Therefore the net cost of coal alone last half year was 4·18d. more than in 1913. The income of £397,177 from residual products is £159,859 more than in the corresponding period of 1914, and £68,192 more than in the same period of 1913. Comparing with the second half of 1914, coke, in yielding £267,336, gave £116,247 more; breeze, in returning £7903, £7623 more; tar and tar products, in contributing £65,518, £35,828 more; and sulphate of ammonia, in providing £56,419, £161 more. Regarding the last-mentioned figure, it might have been expected, in view of the ascending market price of sulphate of ammonia during the year, and the larger quantity of coal carbonized, that there would have been a greater difference to the good.

Turning to the sales of gas, the Directors report that there was a decrease equal to 2·03 per cent., contrasted with the corresponding period of 1914, which half year was less by 4·29 per cent. than the same half of 1913. It is interesting to learn that this was entirely due to the earlier closing of shops and the restriction of public lighting, and that the requirements of private consumers were normal, while the demand for power and various manufacturing purposes improved. Coming to total figures, the sales of gas, amounting to 6,218,421,000 cubic feet, showed a reduction of 129,187,000 cubic feet, compared with the corresponding six months of 1914, and of 413,612,000 feet contrasted with the same period of 1913. Of the reduction last half year, making comparison with the December half of 1914, private consumption [why persist in using the term "private "lights"?], including shops, was responsible for 92,785,000

cubic feet, and public lighting for 36,402,000 cubic feet; while of the reduction compared with the six months of 1913, 340,899,000 cubic feet were due to private consumption, and 72,713,000 cubic feet to public lighting. There is really little use contrasting the receipts for gas, as in the Michaelmas quarter of 1914 the price was 2s. 2d., and in the Christmas quarter 2s. 4d., while 2s. 10d. has ruled throughout the past half year. However, for what the figures are worth, they are given. The total income from gas was £846,991, or an increase of £147,522. Of the total, private consumption contributed £833.702, or an increase of £148,750, and public lighting £13,289, or a reduction of £1228. Rentals from meters, stoves, and fires, and income from gas-fittings, gave a total of £125,031, or £2219 less than in the December half of 1914; but the diminution is entirely due to gas-fittings, which yielded £43,352, as compared with £46,077—a reduction of £2725. All along the line of connections, there has been a healthy increase, so that the fabric of the business has been still further reinforced. Ordinary meters have risen by 181, to 95,616; prepayment meters by 5026, to 280,137; ordinary stoves by 2413, to 86,340; slot stoves by 5717, to 234,619; and fires by 4915, to 54,925. There is gratification in these figures, and in the fact that, in the untoward circumstances of the times, the results have come out so well on a 2s. 10d. price that the dividend at the rate of £4 8s. per cent. has been earned in the half year, with a balance in hand.

Sulphate of Ammonia Export Licences.

THE announcement made last week as to the temporary suspension of sulphate of ammonia export licences will, in view of the magnitude of our overseas trade in relation to the total production of the United Kingdom, probably have caused some alarm among producers. But there are hopes that, though the announcement is couched in very definite language, the position is not altogether so sinister as on the surface it may appear—at any rate, there is good reason to believe that when the situation becomes, by the fact of growing stocks, a little clearer to the comprehension of the Board of Agriculture and the Board of Trade, any withholding of licences to export will soon be relaxed. The notification issued last week commenced with these words: "In view of the uncertainty as to the sufficiency of the "supplies of sulphate of ammonia to meet home demands "during the next few months, it has been decided, on the "recommendation of the Fertilizers' Committee, with the "approval of the President of the Board of Agriculture and "Fisheries and the President of the Board of Trade, to "suspend, for the present, the issue of licences."

This notification is, no doubt, the result of agitation among the farmers in regard to the provision of fertilizers and their prices, of questions and pressure in the House, and of, above all, an admitted inappreciation of the actual position On any one, or the whole, of these grounds, the suspension of licences is altogether unjust. The notification, it will be observed, starts with the confession as to the want of knowledge respecting the sufficiency of the supplies of sulphate of ammonia to meet home demands; and yet the second paragraph begins with the statement that, "under "normal conditions, it is well known that the production of "sulphate of ammonia considerably exceeds home require-"ments." When these two statements are brought into juxtaposition, it would appear to any business man that this was essentially a case calling for the adoption of a middle course, rather than the drastic one suggested. If, however, there was any real uncertainty existing in the minds of the Fertilizers Committee and the Board of Agriculture, they have not, so far as we are aware, taken any independent action in trying to ascertain the facts, and so displace the uncertainty by certainty. Yet the Sulphate of Ammonia Association have placed before them data which should either have satisfied them, or supplied them with a case for making further investigation on their own account, as to what was likely to be the home requirements for sulphate of ammonia for which adequate provision should be made. This, in view of the acknowledged uncertainty, apparently they have not done. Instead, they have at the moment taken the easiest course, without bestirring themselves to follow a suggestion made to them three months since by the Committee of the Sulphate of Ammonia Association, who have been far-seeing and active in relation to the very situation which has now arisen, and which they have done their best to avert, in their conviction, from inner knowledge, that no such drastic action as the entire suspension of export licences (temporary or otherwise) would be necessary. In every way, the Association have met the Board of Agriculture, and done all that was actually requisite to provide for home demands.

Seeking information, Mr. D. Milne Watson, the Chairman of the Association, handed us a circular-letter which, towards the close of last week, was addressed by the Committee to the makers of sulphate of ammonia, and which letter is published in another column. It refers to the suggestion that was made by the Committee of the Association some three months since. They then urged the Government to take steps to obtain information relative to the production, and probable consumption, of sulphate of ammonia in the spring, together with returns from export merchants as to the quantities already sold to foreign countries. This suggestion has been carried out, and it has thus been possible to make an approximate forecast as to possible requirements and supplies, and so determine in advance the quantity that would be available for export each month. The object that the Committee had in mind in making their suggestion was that export licences should be granted at the beginning of each month for the estimated surplus, and that further licences should be issued towards the end of the month if the surplus was greater than had been computed. This would have been a sensible, systematic, and businesslike proceeding. The Government have in their possession particulars regarding the quantities already sold to overseas countries; so that it would have been perfectly easy to have allocated the export licences in proportion to the purchases made by each country—giving such preference to our Allies as might have been deemed necessary. But evidently the Government do not intend to make use of this fundamental information.

Obviously, the Government are proceeding upon false assumptions as to the absorptive power of our agriculturists. Last year the home consumption of sulphate of ammonia for all purposes was about 115,000 tons; and the exports some 294,000 tons. The quantity exported would be a heavy one for this country to absorb. But the notification as to the suspension of exports of sulphate of ammonia appeals to farmers of the country to increase their demands for fertilizers "of all descriptions," in order to stimulate the production of foodstuffs, and to place their orders for sulphate at once so as to enable the expected increased demand to be met without undue delay or difficulty. The Board of Agriculture and other interested departments are either over-sanguine as to the probable response by, and needs of, the farmers of the United Kingdom, or they prefer to be relieved of trouble by making over-provision, without due inquiry, by the simple expedient of totally suspending export licences (except in so far as licences for contracts made before a specified date are concerned), and without much care for the position of the sulphate of ammonia producers. The injustice does not end with the producers. It extends to overseas customers; and it is quite certain that, if persisted in (though there is little fear of this when experience of home demand clears the vision of the Government authorities), it would militate against this country's position when after-war competition sets in with full severity.

However—apart from the statement of Mr. Acland in the House of Commons last Thursday night, that it would be impossible to continue the withholding of licences indefinitely—there is some consolation in respect of the notification as to the present suspension of licences in a letter received by sulphate of ammonia makers from the Board of Agriculture. They ask that returns shall be made on the 1st and 15th of each month, showing the position of the stock of individual producers. Concerning this, the Committee of the Sulphate of Ammonia Association urge that, in view of the existing great difficulty in shipping sulphate, it is desirable that licences should be available before the storage accommodation at a works is absolutely exhausted, inasmuch as there will probably be an interval of at least a fortnight between the issue of licences and the possibility of shipping. The advice is therefore tendered that the Board of Agriculture should be advised before there is danger of the works becoming overstocked. Observation of this advice will operate not only in relieving individual makers, but will assist in modifying a position created by the insufficient knowledge possessed by the Board of Agriculture as to possibilities.

The circular-letter from the Association, as will be seen, also deals with some other matters—among them the agreed

prices for home supplies; and it is quite clear from what is stated that the Board of Agriculture have not kept faith with the Association in respect of the understanding arrived at in regard to spring supplies. Pressure was, subsequent to the undertaking, brought to bear which led to the fixing of a maximum price, conditional (in view of the increased expenses of production, which Mr. Acland recognizes) on the Government taking the necessary steps to see that sulphuric acid was provided at a reasonable cost. But the Government shirk taking action to control the prices of sulphuric acid, probably through the influence brought to bear within the House itself.* The Committee of the Sulphate of Ammonia Association feel keenly over, and speak boldly as to, this matter. "We have sufficient evidence," they remark, "to "show that acid manufacturers are taking advantage of the "shortage of supplies in a scandalous manner." Probably they are applying, under war conditions, the much-abused law of supply and demand, which law, when the demand exceeds the supply, enables producers who are not controlled by a fair spirit to satisfy an inordinate greed for profits. This sulphuric acid question is one calling for as much pressure as possible being brought upon the Government; and as it is a matter in which not only makers of sulphate of ammonia but home buyers are concerned, they should respectively take steps to urge the Government to exert controlling action. It is not justice to press for the limitation of the price of a commodity, when the cost of an important necessary to its production is allowed to take an unrestricted upward flight. However, the work of Government Departments in connection with conditions arising from the war are marked by most flagrant inconsistencies.

National Coal Reserves and Economy.

In his second lecture at the Royal Institution, Professor W. A. Bone pursued the theme of the utilization of coal in the most efficient ways, with the twofold object of realizing the highest possible economy, and securing from the coal the utmost possible value—to the national benefit, present and future. The second lecture, if anything, exceeded the first one in interest, for an audience of composite character—scientists, technologists, and the general public were there; for Professor Bone had several matters of an informative character to impart, and he also got on to the lines along which work must proceed to secure the wealth to be derived from the more efficient use of our expenditure of raw coal. He enforced the necessity for economy in the national interests by showing the proportion of our coal reserves compared with those of other countries. When we come to consider that of the total estimated world's reserves, Great Britain appears rather low in place in the percentages, it makes us ponder over that (happily distant) future when our successors will probably lose their industrial and commercial supremacy for want of cheaply worked supplies of coal, and will then have to turn importers—thus putting an end for ever to the vexed questions of coal exports, the wasteful utilization of our native substance, and many other matters that are polemical in connection with coal to-day.

It is essential that the public should realize the national position in regard to coal reserves, though the public are, as a rule, very indifferent to matters that will be the immediate concern of a somewhat far-off posterity, and is not their own. The United States can boast of the largest percentage possession of the estimated reserves in the world; and when we see that they can claim more than half the total—51·8 per cent.—it is not difficult to peer into the centuries ahead, see visions, and indulge in prophecy, as to what will happen—eventually. The percentage of the world's reserves held by Great Britain is only 2·6—less than one-half that held by Germany. But happy are we in our Dominions beyond the seas; for Canada stands second in the list, with a 16·4 per cent. share in the reserves. Australia has also 2·2 per cent. to her credit—the three items making a total of 21·2 per cent. In the sum, our position is good; but 18·6 per cent. of it is not here. Considering these figures, it must be remembered that our industrial and commercial position has been built up on a cheap supply of easily won coal. Increasing depths, and enhanced costs for wood, labour, &c., mean that coal will never again be so cheap as in the past, unless something miraculous befals. And the Government will, therefore, be lacking in their duty to the country now and hereafter if they do not begin now to do everything possible to improve our economic position through coal, and to protect in ways conspicuously absent in the past this essential to the present and future of our trade position and expansion. We cannot now afford to lose anything that could be brought to our gain; and it is a trust for the discharge of which we are responsible to our country that there shall not be longer than can be avoided any prodigal living in regard to coal. The longer there is postponement of the work of realizing attainable economy, the more difficult will be the task.

Professor Bone considers the question of the statistical exercises that have been from time to time performed as to the probable duration of our coal supply, and dismisses them as being of academic interest, but of little practical value. He is right in this. The question for us is one of comparison with our trade competitors of other nations—in other words, how long shall we be able to get coal at home at a price that will not place us at a disadvantage relative to our nearest trade competitors. There is a point, fundamental and vital, for our political economists, who have not yet been sufficiently wise to carry their penetration, in preparing their trade-expansion disquisitions, to the very bedrock of our industrial prosperity. Speak to them on this subject, and some will begin to babble of the reduction of exports as a means of preservation of the part of our stores of coal that is the cheapest to raise. Professor Bone is not a willing controversialist over points of policy of this kind; but he cannot see that coal exports and our maritime supremacy can be dissociated. The one, in his opinion, goes with the other. Whether, however, there is anything that is likely to arise from an expansion of home industries and that will offer compensation in exports to a reduction of the quantity of coal shipped, he does not say, and we cannot predict; it is a point that rests with the evolution of our national affairs. But he leaves speculation for more practical ways of producing economy; and comment upon these can remain until we have before us the third and final lecture, though many suggestions as to both industrial and domestic sources of economy are embodied in the one that is published to-day.

Sliding-Scale Suspension

Regarding the suggestion put forward in these columns more than once, that an attempt should be made to secure the suspension of the sliding-scale under the extraordinary circumstances of the war, the view was expressed last week that (for having effect during the war period) the time had passed when there was a chance of the matter being considered by Parliament, in view of the recent resolve as to the character of the legislation to which, while the war lasted, there is willingness to devote attention. As has been pointed out in these columns, such conditions as those brought about by the war were never contemplated at the inception of the sliding-scale; and, apart from the war, we are in the future likely to have very extraordinary conditions with which to contend, and which may bear severely upon gas investors under the sliding-scale. Therefore, in these circumstances, it would be an excellent thing if it were possible to invest the Board of Trade with the power of suspension of the sliding-scale when, in their opinion, circumstances justified. The present time would be particularly opportune for raising this question, if Parliament would bestow consideration upon it; but it is pretty certain that they would not. The matter would also have to be brought forward in the name of sliding-scale companies generally. It would be little good for individual companies introducing the question, in view of the fact that the sliding-scale is a piece of general gas legislation which would have to be dealt with, in respect of any modification, on a general basis.

And Hesitation.

But the only Association that could organize an application to Parliament for the suggested amendment are not, we understand, prepared to do so—not because the present time is inopportune, but because they fear "reprisals." In other words,

* As we go to press the Sulphate of Ammonia Association inform us that the Government have at length decided to "control" the acid manufacturers. It is satisfactory to hear that the Association's representations have induced the Government to take the first indispensable step towards obtaining control; and it is to be hoped that a real attempt will now be made to regulate prices and distribute supplies of this fundamental necessity of the whole chemical industry in the manner most consonant with national interests as a whole.

although the sliding-scale does not make provision for an appeal under exceptional circumstances, it is thought that it would be distinctly disadvantageous to the industry to urge any change in the conditions. It is considered that, if an attempt were made to vary the sliding-scale in consequence of current circumstances, the probabilities are that, when conditions are more favourable to sliding-scale companies, there would be an endeavour to secure an alteration in the sliding-scale in favour of the consumers. Really we cannot see what the gas industry has to be afraid of; and we must dissent entirely from the submission that, "in a sense, the sliding-scale was designed to meet" circumstances such as the present. If this were true, then, when to-day we view certain depreciated dividends and gas stock and share values, the thought crosses the mind that a very bad job was made of the fitting of the sliding-scale to meet extraordinary conditions. Some provision is required for this purpose, because some sentient observers are of opinion that extraordinary circumstances are not going to be confined to the war, but are likely to arise for this country rather more frequently in the future than in the past.

Municipal Loan Charges.

The occasion has now arrived which will put to a severe test very many manners and methods in relation to which no serious trouble was likely to arise so long as times of peace and plenty ruled. With the urgent need for economy in public expenditure, has come the problem of finding directions in which it may be fruitfully exercised. But these, to produce savings of any moment, are not always easy to find; though in the smaller things, much ingenuity in cutting-down has been manifested. One has read of the local authority who decided to save in the printing bill by omitting from their records the commas and other marks of punctuation; of another body who have determined to mix coke with the coal for their fires; and of a resolve to provide nurses with a medium weight cloak suitable for wearing all the year round. Beyond their possible value as signs of a desire to save, such actions as these are likely to prove of but little use to ratepayers. The putting off of work requiring to be done may in the end, too, prove to be a dearly bought saving; while in the main the financial policy must be ruled by the system created in the past. The endeavours made to secure the suspension of the operation of sinking funds for the period of the war had reference to what is an important part of the burden of local governing authorities; and "Surveyor," in a second article [his first was noticed recently] dealing with the financial affairs of Liverpool, deplores the fact that the City Council have for years, "in accordance with a long-established municipal principle, been piling-up debts, and through postponing one evil day have created another." No doubt, it is at a time when economy is called for that the question is asked whether the system which has been in vogue for so many years, of borrowing money for municipal undertakings, is a wise one. But it is useless to ask it now—when money, except in very exceptional circumstances, cannot be borrowed at all. "Surveyor" should reprint after the war his plea for the overthrow of the loan principle. He may then succeed in inducing municipal bodies to radically alter their policy and ratepayers to take a more intelligent and abiding interest in local government affairs. But this is certainly a good deal to hope for.

To-morrow (Wednesday) evening the Society of Public Analysts hold their annual general meeting; and after the formal business has been transacted, Mr. W. J. Burgess will read a paper entitled "Notes on Common Processes Used in Water Analysis."

We have received from Messrs. Crosby Lockwood and Son a copy of "Sulphuric Acid and Sulphur Products," by Geoffrey Martin, D.Sc., and Major J. Louis Foucar, B.Sc. Pending a fuller notice of the work, it may be mentioned that the book is published at 7s. 6d. net.

The Illuminating Engineering Society will hold their next meeting at the Society of Arts, Adelphi, on the 22nd inst., when there will be a discussion on "Some Future Possibilities in the Design of Instruments for Measuring Illumination (with Special Reference to Photometers Depending on Physical and Chemical Methods)."

At the meeting of the London Section of the Society of Chemical Industry on the 6th prox., Professor W. A. Bone will read a paper on "The Economy of Fuel." At the Newcastle Section meeting on Wednesday, the 16th inst., Professor H. E. Armstrong will deal with the "Problems of Coal with Reference to the Proper and Complete Utilization of our Coal Supplies."

PERSONAL.

Mr. Arthur Valon has recently been appointed military representative to the Chiswick local tribunal in the 7th R.D. recruiting area.

Lieutenant R. Staley, R.E., reported wounded, was, prior to enlistment, Works Superintendent of the Londonderry Gaslight Company. He is a native of Derby.

We hear that Mr. Maurice Graham, who has been working for the Ministry of Munitions at Plymouth for some months (having given his services in the carrying out of important work), has been offered, and has accepted, a position as Director under the Ministry, and will now be transferred to a sphere wherein his practical experience should show good results. We wish him all success in the work he has undertaken.

Deep sympathy will be felt with Mr. Thomas Glover, of Norwich, whose son Second-Lieutenant S. L. Glover has been officially recorded as missing. With a photograph, the "Eastern Daily Press" last Wednesday published the following information relating to Lieutenant Glover: He joined the Public Schools Battalion with other well-known Norwich lads. He was trained at Aldershot and elsewhere, and received a commission on Jan. 1 last year in the 10th West Riding Battalion (Duke of Wellington's). The young officer was sent abroad last August, and soon went to the front, where he did a considerable amount of patrol work, and gained important information from time to time.

In the list of officers mentioned in Sir John French's despatch dated Nov. 30 for "Distinguished Service in the Field" appears the name of Lieut. E. W. Bennett, a member of the Brentford Gas-Works staff. This gallant young fellow at the outbreak of the war joined His Majesty's forces as a motor despatch rider, and was immediately sent out with the Expeditionary Force to France. Later on he was gazetted to a commission in the motor machine gun service; and, on Sir John French's recommendation, he has been awarded the Military Cross. Another employee of the Company, Sergeant L. A. Titcombe, who is serving in the 1/8 Battalion Middlesex Regiment, and has been in the thick of the fighting on the Western Front, has been awarded the D.C.M. for gallant conduct in the field.

The Victoria Cross has been conferred on Corporal Alfred Burt, of the 1st Battalion of the Hertford Regiment (T.F.), an old employee of the Hertford Gas Company, for conspicuous bravery at Cuinchy on Sept. 27 last. His company had lined the front trench preparatory to an attack, when a large minenwerfer bomb fell into the trench. Corporal Burt, who well knew the destructive power of this class of bomb, might easily have got under cover behind a traverse; but he immediately went forward, put his foot on the fuse, wrenched it out of the bomb, and threw it over the parapet, thus rendering the bomb innocuous. His presence of mind and great pluck saved the lives of others in the traverse. The gallant corporal went to Hertford as a fitter's boy after leaving school; and he later on was with the Basingstoke Gas Company as a fitter until just before war broke out, when he joined his regiment.

OBITUARY.

Mr. John A. Davis, who died with startling suddenness while presiding at a meeting at the Kilkenny Town Hall, was Secretary of the Kilkenny Gas Company, and acted as agent for the Marquis of Ormonde's property in the city.

The death took place last Wednesday night, after a brief illness, of Mr. Thomas J. Carless. Deceased, who was in his 89th year, was the oldest Director of the Richmond Gas Company, of which he had for a very long time occupied the position of Chairman. For over half-a-century he served on the Richmond Select Vestry; and on the occasion of his jubilee as a member, a resolution was passed placing on record the Vestry's high appreciation of his work.

By the death last Friday of Sir Hugh Owen, G.C.B., in his 82nd year, the Gas Light and Coke Company have lost a Director who will be greatly missed by his colleagues. He was for many years a member of the Court of the Company, and was re-elected to his seat at the shareholders' meeting in February, 1914. Sir Hugh, who was also a Director of the Hornsey Gas Company, was one of the Arbitrators appointed (along with Sir Edward Fry, who acted as Chairman, and Sir John Wolfe-Barry), under the Metropolis Water Act of 1902, to determine the price to be paid by the Metropolitan Water Board for the undertakings of the London Water Companies. The Arbitration Court commenced their sittings in May, 1903. He became Permanent Secretary of the Local Government Board in 1882, and continued to hold this office for sixteen years.

Scottish Junior Gas Association Prizes.—The Council of the Scottish Junior Gas Association (Western District) announce that, as a result of the decisions (by letter) of the five members who were asked to act as adjudicators of last session's papers, the first prize goes to Mr. David Fulton, of Helensburgh, for his paper on "Carbonization in Vertical Retorts;" and the second prize to Mr. Archibald P. Dale, of Beith, for his paper entitled "A Country Gas-Works—Past and Present."

THE GAS LIGHT AND COKE COMPANY.

Half-Yearly Report and Accounts.

THE following is the report of the Directors of the Gas Light and Coke Company for the half year ended Dec. 31, which, with the accounts [some particulars from which are given below], will be presented at the ordinary general meeting on Friday.

The accounts for the past half year show that, after providing for fixed charges, setting aside £5000 towards the redemption fund, and contributing £10,000 to the special purposes fund, there remains a profit balance of £353,427 5s. 11d. The amount brought forward from the previous half year being £436,058 11s. 8d., there is a total available balance of £789,485 17s. 7d., out of which the Directors recommend the payment of a dividend on the ordinary stock at the rate of £4 4s. per cent. per annum, which will absorb £342,870 17s. 8d., and leave £446,614 19s. 11d. to be carried forward to the credit of the current half year.

The sales of gas for the half year show an increase of nearly 1½ per cent. compared with the quantity sold during the corresponding period of 1914.

There has been an increase during the six months of 5367 in the number of consumers, and of 31,044 in the number of gas-stoves sold and let on hire.

The freights paid for coal and oil continue at a very high level, and show an enormous increase over those of pre-war times.

The Directors have written-down the value of the Company's invested funds by £24,897.

The quinquennial re-valuation of the Company's property has now been concluded, and has resulted in material reduction of the assessment.

The shareholders will be pleased to know that about 2600 of the Company's employees have joined His Majesty's Forces.

The Court of Directors has been furnished by the several Engineers of the Manufacturing and Distributing Departments with certificates that all the Company's works and plant have been maintained in thorough efficiency.

CORBET WOODALL, *Governor.*

Horseferry Road, Westminster, S.W., Jan. 20, 1916.

The Accounts.

The accounts accompanying the report consist of the usual statements.

The statement of capital (stock) sets forth that the total paid-up is £10,413,480; added on conversion, £12,832,955—total amount authorized, £23,246,435. Deducting the amount redeemed, £257,015, the total amount of the Company's existing capital powers is £22,989,420. The statement of loan capital stands thus: Total paid up, £3,186,660; added on conversion, £1,618,190; unissued, £750,000—total amount authorized, £5,554,850.

The capital account shows receipts (with premiums, £1,688,957 14s. 8d.) to the amount of £29,513,247 14s. 8d. The expenditure is shown in the following items:—

Expenditure to June 30, 1915		£14,824,540 5 1
Expenditure during the half year to Dec. 31, 1915—viz.:—		
Lands acquired, including law charges	£5,415 16 11	
Buildings and machinery in extension of works	2,430 0 0	
New and additional mains and service-pipes	8,965 10 2	
Do. do. meters	14,911 12 8	
Do. do. stoves	40,174 15 5	
	71,897 15 2	
	£14,896,438 0 3	
By depreciation of plant	£65,149 11 2	
„ depreciation of meters and stoves	63,165 7 0	
	128,315 18 2	
Total expenditure	£14,768,122 2 1	
Nominal amount added on conversion	14,451,145 0 0	
	£29,219,267 2 1	
Deduct amount of capital redeemed under Company's Act of 1903	257,015 0 0	
	£28,962,252 2 1	
Balance of capital account	520,975 12 7	
	£29,483,227 14 8	

The total of the net revenue account is £1,040,372 7s. 11d., compared with £984,824 on Dec. 31, 1914. The balance applicable to the redemption fund and to dividend on the ordinary stock is £794,485 17s. 7d.; and the following statement shows how it is proposed to appropriate it:—

Dec., 1914.			
£535,314	..	Net balance brought from last account	£436,058 11 8
240,892	..	Net revenue for the half year	358,427 5 11
£776,206			£794,485 17 7
10,000	..	Contribution to redemption fund	5,000 0 0
£766,206			£789,485 17 7
(£4 13s. 4d. p. ct.)		Dividend on the ordinary stock—	
£381,668	..	£4 4s. per cent. per annum on £16,327,185	342,870 17 8
£384,538	..	Balance carried to next account	£446,614 19 11

The three statements relating to the reserve, special purposes, and depreciation funds stood as follows on Dec. 31: Reserve fund, £75 847; special purposes fund, £322,149; depreciation fund, £80,815.

REVENUE ACCOUNT—*Expenditure.*

December Half Year, 1914.		£ s. d.	£ s. d.
	Manufacture of gas—		
£659,521	Coal, including all expenses thereon	887,263 2 10	
100,847	Oil „ less value of oil tar	1.5,694 10 0	
44,845	Coke and breeze used in the manufacture of carburetted water gas	59,610 3 8	
15,815	Salaries of engineers and other officers at works	16,191 6 4	
91,280	Wages	102,137 12 6	
13,556	Purification	11,575 13 9	
210,935	Repair and maintenance of works and plant, materials and labour, less received for old materials, £4912 7s. 1 d..	261,895 1 7	
	Distribution of gas—		1,454,367 10 8
59,524	Salaries and wages of officers (including rental clerks)	63,545 5 9	
93,329	Repair and maintenance of mains and service-pipes, &c.	96,285 1 6	
88,904	Repair and renewal of meters	92,754 12 8	
04,499	„ „ stoves	107,3 8 17 0	
16,232	Gas-fittings, including labour (automatic meter supplies)	13,526 10 1	
		..	373,500 7 0
28,446	Public lamps—lighting and repairing	..	29,097 3 6
	Rents, rates, and taxes—		
7,110	Rents payable	7,306 1 10	
162,418	Rates and taxes	172,511 5 10	
			179,817 7 8
	Management—		
3,750	Directors' allowance	3,750 0 0	
300	Company's Auditors and Assistant	304 4 0	
9 728	Salaries of General Manager, Secretary, Accountant, and clerks	10,274 0 3	
27,101	Collectors and cashiers	28,849 7 11	
5,518	Stationery and printing	5,586 11 8	
8,1c3	General charges	7,393 6 10	
			56,157 10 8
17,000	Co-partnership, for the half year	..	4,600 0 0
67	Parliamentary charges	..	123 15 10
1,020	Law charges	..	485 14 7
..	Charges *re* Quinquennial re-valuations	..	1,050 0 0
6,076	Bad debts	..	7,676 0 0
500	Depreciation fund for works on leasehold lands	..	500 0 0
27,859	Annuities to officers and workmen, including contribution to officers' superannuation fund	..	27,135 12 5
7,124	Allowances to employees on Active Service	..	7,165 11 3
2,011	Workmen's compensation	..	2,786 17 11
4,317	Company's Contribution under National Insurance Act, 1911	..	4,218 6 11
	Public officers—		
860	Gas Referees and Official Auditor	857 2 0	
566	Public testing stations	653 12 3	
			1,510 14 3
1,819,164			2,150,193 12 8
449,510	Balance carried to net revenue account		604,313 16 3
2,268,674			2,754,507 8 11

Revenue.

December Half Year, 1914.		£ s. d.	£ s. d.
	Sale of gas—		
£1,569,791	Per meter at 3s. and 2s. 10d. per 1000 cubic feet	1,851,195 15 9	
50,484	Public lighting and under contracts	47,520 9 2	
1,620,275			1,898,716 4 11
75,358	Rental of meters	..	76,743 7 6
75,503	Rental of stoves	..	78,8 2 1 5
93,388	Rental of fittings	..	94,086 0 11
	Residual products—		
243,492	Coke, less labour, &c.	369,093 4 9	
11,023	Breeze, less „ „	27,900 10 2	
68,457	Tar and tar products	82,:60 14 8	
75,073	Ammoniacal liquor and sulphate of ammonia	120,301 5 2	
398,045			600,061 14 9
5,926	Rents receivable		5,808 1 11
173	Transfer fees		199 7 6
2,268,674			2,754,507 8 11

The remaining statement is the balance-sheet, which gives the value of the stores on hand at the close of the half year as follows: Coal, £289 528; gas oil, £88,658; coke, £32,943; tar and ammoniacal liquor and products, £146,132; and sundries, £401,361. The figures this time last year were: Coal, £112,762; gas oil, £2',115; coke, £32,389; tar, ammoniacal liquor, and products, £136,057; sundries, £357,009.

Statement of Coal.

—	In Store June 30, 1915.	Received During Half Year.	Carbonized During Half Year.	Used During Half Year.	In Store Dec. 31, 1915.
	Tons.	Tons.	Tons.	Tons.	Tons.
Coal	181,300	917,267	829,040*	1755	267,772

* In addition to this quantity of coal, 8,070,073 gallons of oil were used during the half year.

Statement of Residual Products.

Description.	In Store, June 30, 1915.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store Dec. 31, 1915.
Coke—tons	11,658	514,115	101,301	373,790	50,682
Breeze—tons	1,235	126,960	13,969	93,123	21,103
Tar, from coal only—galls.	2,276,431	8,197,334	8,047,566	357,506	2,068,693
Ammoniacal liquor—butts	20,c81	2 3,277	214,669	..	28,689

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold.		Total Quantity Accounted for.	Number of Public Lamps.
	Public Lights and Under Contracts (Estimated).	Private Lights (per Meter).		
Thousands.	Thousands.	Thousands.	Thousands.	
*13,856,399	242,826	12,662,931	13,082,990	44,740
†13,813,324	378,985	12,348,056	12,895,929	44,768

* Including 3,251,984,000 cubic feet of carburetted water gas. † December half year, 1914.

SOUTH METROPOLITAN GAS COMPANY.

The Directors' Report and the Accounts.

THE following is the report of the Directors of the South Metropolitan Gas Company for the six months ended the 31st of December, which, with the accounts (an abstract of which appears below), will be presented to the proprietors at the half-yearly meeting to-morrow week.

After payment of dividend at the sliding-scale rate of £4 8s. per cent. per annum, the working results for the half year show a surplus of £29,176. Placing £10,000 of this to the insurance fund (which was greatly depleted as a result of the coal strike), the balance of £19,176 will increase the amount carried forward to £23,968.

The governing factor of the accounts is, as usual, the cost of coal and freight; and it seems unlikely that any relief from these burdens can be expected during the war. The increased price of gas and the reduction of the dividend and co-partnership bonus, would have been insufficient of themselves to meet these excessively high charges, but some improvement has taken place in the value of residual products.

There is a further reduction in the amount of gas sold equal to 2·03 per cent. below the figure for the corresponding half year, which itself was less by 4·29 per cent. than that of the comparable pre-war period. This result is entirely due to the earlier closing of shops and the restriction of public lighting. The requirements of private consumers are normal, while the demand for power and manufacturing purposes has improved.

Owing to the heavy cost of coal and freight, which has continued too long to be regarded as of a temporary character, it has become necessary to increase the floating capital of the Company to meet these requirements. The Board are therefore asking the consent of the shareholders to the promotion of a Bill for this purpose in the coming session of Parliament—the Wharncliffe meeting being held immediately after the ordinary half-yearly meeting on the 9th inst.

Shortage of labour, both skilled and unskilled, has been a source of great anxiety to the officials during the past few months, and has materially hampered the Company's operations. Of the Company's staff, 2218 are serving with His Majesty's Forces.

The post of Chief Engineer has been filled by the appointment of Mr. G. M. Gill, formerly Assistant Engineer to the Commercial Gas Company.

Two Directors (Mr. Frank Bush and Mr. Frank Harding Jones) and one Auditor (Mr. Thomas Spooner Soden) retire by rotation. They are eligible, and offer themselves for re-election.

CHARLES CARPENTER, Chairman.

709, *Old Kent Road, S.E., Jan.* 26, 1916.

The Accounts.

The following are the principal portions of the accounts accompanying the preceding report.

The first two statements relate, as usual, to the stock and loan capital. The former sets forth that the standard rate of 4 per cent. is payable on £6,011,224 and £598,671 (Act of 1901) of stock; while the latter shows that the loan capital, the rate of interest on which is 3 per cent., amounts to £1,798,994 and £96,451 (Act of 1901). The third statement is the capital account. It stands as follows: Amount received, £5,476,420; nominal amount added by conversion (less premium), £3,028,920—total, £8,505,340. The items of expenditure are as follows:

Capital account to June 30, 1915		£5,215,736 17 1
Expenditure during half year to Dec. 31, 1915—viz.:		
New buildings and machinery	£33,699 0 0	
New and additional mains and services	2,568 0 3	
New and additional meters	2,395 11 0	
New and additional stoves	4,348 2 8	
		43,010 13 11
Total expenditure		£5,258,747 11 0
Balance		217,672 9 0
		£5,476,420 0 0
Nominal amount added by conversion, less premium		3,028,920 0 0
Total		£8,505,340 0 0

REVENUE ACCOUNT—*Expenditure.*

Manufacture of gas—		
Coal into store, including £4455 19s. 11d. for London Port and tonnage dues	£646,467 17 10	
Purification	12,551 16 9	
Salaries of Engineer and Officers at works	19,101 10 1	
Wages (carbonizing)	52,027 5 6	
Repairs and maintenance of works and plant, less £4444 18s. 5d. received for old materials	99,520 5 2	
		£829,668 15 4
Co-partnership		7,000 0 0
Distribution of gas—		
Repair, maintenance, and renewal of mains and service-pipes	£37,822 13 2	
Salaries and wages of officers, including rental clerks	23,083 0 9	
Repair and renewals of meters	32,527 14 0	
Repair and renewals of stoves	34,498 13 2	
Repair and renewals of gas-fittings	30,782 14 5	
		158,714 15 6
Public lamps, labour and materials £15,152 2s. 7d., less £14,085 1s. 8d. received for the same		1,067 0 11
Rents, rates, and taxes—		
Rents payable	£1,422 15 3	
Rates and taxes	57,700 13 2	
		59,123 8 5
Management—		
Directors' allowance	£2,800 14 2	
Salaries of Secretary, Accountant, and clerks	3,755 5 1	
Collectors { Ordinary	5,790 13 6	
Collectors { Slot meter	11,737 19 2	
Stationery and printing	3,754 17 3	
General charges	13,024 16 10	
Company's Auditors	112 10 0	
		40,986 16 0
Miscellaneous—		
Law charges		2,139 7 10
Parliamentary charges		18 4 6
Bad debts		2,222 10 9
Stolen from £1 slot meters broken open		110 7 8
Superannuation, sick, and accident funds		16,810 4 9
National Insurance Act charges		2,305 7 4
Gas Referees and Official Auditor		354 12 8
Leasehold renewal fund		500 0 0
War Bonus and War fund		31,505 10 3
Total expenditure		£1,152,527 1 11
Balance carried to net revenue account		218,218 9 6
		£1,370,745 11 5

Receipts.

Sale of gas—		
Michaelmas at 2s. 10d. per 1000 feet	£349,087 4 2	
Christmas, at 2s. 10d. per 1000 feet	484,615 1 1	
	£833,702 5 3	
Public lighting	13,289 7 10	
		846,991 13 1
Meters at rent: Ordinary, 95,616; slot, 280,137	£43,206 3 6	
Stoves at rent: Ordinary, 86,340; slot, 234,6 9; fires, 54,925	38,472 17 5	
Gas-fittings at rent	43,352 2 4	
		125,031 3 3
Residual products—		
Coke, less labour and cartage	£267,336 4 4	
Breeze, " "	7,993 7 11	
Tar and tar products, less labour	65,518 9 3	
Sulphate of ammonia " "	56,419 8 3	
		397,177 9 9
Rents receivable		1,474 12 10
Transfer fees		70 12 6
Total receipts		£1,370,745 11 5

Total amount paid in salaries for half year, £45,074 19s. 4d.
" " " wages " £293,162 9s. 3d.

The net revenue account shows a sum of £169,386 applicable to dividend on the ordinary stock. The balances of the reserve, renewal, and insurance funds stood as follows on Dec. 31 last: Reserve fund, £200,972; renewal fund, £27,535; insurance fund, £36,613.

Statement of Coal.

In Store June 30, 1915.	Received During Half Year.	Carbonized During Half Year.	Used During Half Year.	In Store Dec. 31, 1915.
Tons.	Tons.	Tons.	Tons.	Tons.
153,498	627,503	552,492	1309	227,200

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold.		Total Quantity Accounted for.	Number of Public Lamps (Incandescent).
	Public Lights (estimated).	Private Lights (per Meter).		
Thousands.	Thousands.	Thousands.	Thousands.	
6,783,474	119,800	6,098,621	6,314,049	24,864

Statement of Residual Products.

Description.	In Store June 30, 1915.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store Dec. 31, 1915.
Coke—tons	24,209	341,047	81,916	229,214	54,126
Breeze—tons	31,797	66,337	28,974	33,464	35,696
Tar—gallons	619,055	5,340,349	5,360,931	4,068	624,405
Ammoniacal liquor—butts	9,546	208,557	208,283	..	9,820

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal, £250,104; coke and breeze, £60,808; tar, ammonia, and products, £72,968; and sundry plant and stores, £312,295. The figures this time last year were: Coal, £110,204; coke and breeze, £41,700; tar, ammonia, and products, £82,231; and sundry plant and stores, £345,831. A sum of £63,693, co-partnership bonuses and savings, has been deposited with the Company; and the total of the superannuation and guarantee funds is £91,384. The figures last year were £75,220 and £72,750.

ELECTRICITY SUPPLY MEMORANDA.

BREAKDOWNS of electricity plant have been unpleasantly frequent of late—some through fires and explosions, and some through plant defects. Only on Dec. 21 reference was made in the "Memoranda" to some recent failures,

Breakdowns.

at Belfast, Dublin, Birmingham, Wolverhampton, Wednesbury, Wigan, and Finchley. But the list has since been extended. Shrewsbury welcomed the New Year by a collapse of the electric current during lighting hours; and in some parts of the town, those who had put their trust in the fidelity of the current were convinced of their folly by a two hours' cessation of supply. A smaller occurrence was that at Leeds two days later, when, through the fusing of an electric cable, some twenty shops were thrown back in their lighting arrangements to pre-gas times. On the 10th ult., Aberystwyth had a turn. A fire took place in the cable trench between the dynamos and switchboard; and it did such a variety of damage that users bemoaned for two days their ill-fortune in having changed from a reliable to an unreliable light. On the 11th, at Wallasey, owing to an accident to one of the turbines at the generating station, there was no current for lighting early in the evening, and only an intermittent tramway service could be run. Later in the evening, the station put forth more effort, and succeeded in supplying all the demands then made upon it for light; but the tramway service, according to the report, had to rest for a couple of hours. These splendid advertisements for gas have caused the "Electrician" to read central station engineers a little homily on the folly of running electricity works with insufficient reserve of plant. It is acknowledged that breakdowns occur more frequently as time goes on; and as recent examples, Halifax, Wallasey, and Wigan are quoted—the first named being an addition to our list. Generating plant is expensive for standby purposes; but it is necessary, in view of the slightness of the barrier against failure where plant is running fully loaded. As our contemporary points out, where generating plant is operating at full load, "the overloading of a set at intervals is impossible;" and a breakdown must occur sooner or later. But several recent breakdowns have been due to causes other than generating plant. Gas has ample protection, both in the character of its manufacturing plant and in its gasholders; and nothing but disturbance of the subsoil in which the distributing system reposes would cause a breakdown between works and consumer, and then it would be but local. We have much in the gas industry for which to be thankful respecting the important factor of reliability in artificial lighting.

Pooling Trucks and Coal Prices.

There are electricity managements that are still in trouble over their coal deliveries and prices. The Marylebone Electricity Department does not like the appearance of the proposal to pool private owners' waggons, and for the same reason that many other buyers of coal object to the scheme. Wisely the Council entered into their coal contracts for electricity generation with contractors and factors who own considerable numbers of waggons, and who are thus able to supply coal with considerable regularity and expedition. If the pooling arrangement is carried out, it is feared that the Council will be placed in a precarious position with reference to the adequacy of supply. Still Marylebone has nothing more of which to complain than many other undertakings; but this does not make any difference to their right of viewing the position with fear and trembling, and of lamenting with others the real injustice of the proposal. Then the Luton Electricity Committee are in discussion with their coal contractors over a matter of interpretation of the Price of Coal Limitation Act; and the Board of Trade have been asked for their opinion. As we understand the position, the Council are contending for 7s. as being the price upon which the standard of 4s. should be placed—the 7s. apparently being the pithead price that they paid for Ibstock coal in 1914. But the colliery people say they are entitled to 13s. 3d., which is only 4s. per ton in excess of the average price per ton received by them during the year ending June 30, 1914. In other words, they submit that they are not restricted by the Price of Coal Limitation Act to (in fixing new prices) the actual price paid by any one purchaser. The Act says: "The price of coal of the same description, sold in similar quantities and under similar conditions affecting the sale at the pit's mouth, at the same coal mine, on the *corresponding date* (or as near thereto as, having regard to the course of business, may be practicable) *in* the twelve months ended the 30th day of June, 1914." Nothing is said about pooling the pithead prices obtained over the year, and dividing the aggregate by the number of tons of coal sold.

The Cooker in the States.

Our esteemed contemporary, the "Electrical Review," calls attention to a report on the subject of electric-cooking conditions in the Western States, which has been presented at the Portland Convention of the N.W. Electric Light and Power Association. The area covered by the report embraces 389,842 domestic electric lighting consumers, of whom 220,042 use gas as fuel, and 2481 electricity; leaving 167,319 employing some other form of fuel. The reporters consider the ways and means of securing a large proportion of the latter as electric cooking consumers, wisely regarding it as unnecessary or undesirable to compete with the gas-cooker. Our contemporary apparently thinks that electricity suppliers cannot adopt such a benevolent attitude in this country, inasmuch as the gas-cooker has so "effectively penetrated into the houses of practically every class of consumer that electric cooking must necessarily be—and even now is, in a small way—in competition with gas cooking here." There is a good deal in the report that is supposed to be of a quite disinterested order, having come from a "gas-electric" man; but as the good old crusted postulations of the electrical cooking people this side (which for years have had currency and small effect) are practically reproduced in the report, the indications are that the gas-electric man has electricity more strongly on the brain than gas. It is considered that in the Western States, electric cooking business can be secured with electricity at 1½d. per unit, because of its "inherent advantages, and the less shrinkage of food." The "inherent advantages" have been pointed out very frequently in these columns—the necessary slowness of operations, the terrible costliness of all boiling operations on the hot-plates, the need for standing guard over the oven-doors so as not to lose from that way any of the precious heat, the nerve-racking and temper-disturbing breakdowns, et cetera (which should be in capital letters). As to the shrinkage, if temperatures are arranged for slow cooking in the gas-oven, there is no necessity for any more evaporation of the water content of the meat, or the drying-up of the solids, than with electric cooking. Shrinkage is all a question of temperature and time. Our contemporary presumes that gas costs 3s. to 4s. per 1000 cubic feet in the Western States, and says that "investigators interested in the gas business believe that electricity at 1d. per unit more nearly equals gas at the prices mentioned." We have never heard of such investigators, unless they are electricians whose "interest" in the gas business is that of purblind rivals. We have heard electricians say it is no use attempting to compete here with gas at a charge for electricity greater than ½d. per unit, when gas is at 2s. 6d. per 1000 cubic feet; and one may be sure they were making the best possible of a bad job. For water heating, the report suggests a rate of 0·4d. to 0·5d. per unit. That is bad for electricity in this country with gas in normal times so much lower in price than the charges "presumed" above for the Western States, which are too low.

Some Further Views.

The "gas-electric" man gives reasons why there are few people cooking with electricity, even where the 1d. per unit rate is in competition with a gas rate of 5s. 3d.!—not 3s. to 4s. The first is that people are accustomed to gas-stoves, water-heaters, and other devices, and do not care about changing from the known to the unknown. Experience, too, circulates. First cost in connection with electric cooking is another drawback. A further reason is the lack of an electric water-heater which is as satisfactory as a gas water-heater. The "Review" thinks the gas-cooking habit in this country is due in great part to the low terms on which the consumer can obtain the necessary apparatus—"terms so low that one suspects future gas consumption bears a proportion of the capital charges." Our contemporary has been studying analyses of gas income and outgoings; and it does not seem to recognize several things—for example, that the figures are spread over all the gas sold for lighting, power, industrial heating, domestic heating, and cooking, and not merely over the gas sold through stoves and other appliances on hire. The gas for heating and cooking is sold at lighting rates, and not at (say) one-fifth to one-tenth part of these. There are several gas concerns which, in view of this, undertake the maintenance not only of stoves on hire, but of stoves privately owned; and they can afford to do it. The figure for maintenance also embraces the charge for depreciation. It must not be forgotten by our competitors that a large proportion of the apparatus that has to be maintained is paid for by the prepayment consumers through the extra charge made for the gas; and the maintenance includes the fittings used for lighting. But to return to the gas-electric man. He asserts that there is greater cleanliness in electric cooking than in gas cooking, and that electricity does not "burn up any of the oxygen in the room." This is the unconscious revival of a piece of old electrical humour. Nature provides plenty of oxygen for her processes of heat provision by combustion; and so long as there is sufficient oxygen for combustion, there is more than enough for persons in the same room, and without any impairing of vitality. It is really marvellous, when one comes to think over the matter electrically, how the stokers in the boiler-room of an electricity station can live, in view of the rate at which the oxygen of the atmosphere is used up! However, the gas-electric man very kindly concludes that the gas business in general will not be hurt by electric cooking, but will be improved as electricity becomes more of a competitor, and with this the authors of the report generously agree. We thank them for this piece of consolation.

The Water-Heating Folly.

The "Ferranti" water-heater has been receiving a little "puff" in the electrical papers; and the results attributed to it are highly entertaining to people accustomed to getting their water heated by quick and cheap means. The heater can be had in the form of an attachment for existing cisterns, or can be supplied with cistern complete. In the latter form, the heater may be used either separately or in league with

the existing kitchen boiler. We suggest that, from a consumers' point of view, the latter method would be preferable. The heating element is contained in a chamber having outlets above and below. The heater is mounted on the circulating-pipe connecting the top and bottom of the cistern; and the heated water rises to the top of the cistern, whence it is drawn off. The heater is made in five sizes: 23 gallons, 350 watts per hour; 23 gallons, 500 watts; 34 gallons, 350 watts; 34 gallons, 500 watts; 34 gallons, 700 watts. The dimensions of No. 1 heater over all are 22 in. wide, 29 in. deep, 48 in. high; and of No. 5, 25 in. wide, 32 in. deep, 48 in. high. The net weight of the No. 1 heater with the cistern empty is 220 lbs.; and of the No. 5 heater, 310 lbs. The following table gives particulars of the performance of the water-heater as obtained under actual domestic working conditions:

Size No.	Gallons of Water Raised through 60° Fahr.			
	Every ½-Hour.	Every Hour.	Every 6 Hours.	Every 24 Hours.
1 and 3	0·78	1·56	9·50	38·00
2 and 4	1·10	2·20	13·20	53·00
5	1·50	3·00	18·40	73·50

From this it will be observed that with feed water at 50° Fahr. the No. 1 size heater will give 1·56 gallons of water at 110° Fahr. one hour after switching on, or after all the hot water has been drawn off. Looking carefully at the figures, one may be pardoned for asking if Job is still alive.

Another Tungsten Arc Lamp.

Reference was recently made in the "Memoranda" to the new tungsten lamp developed by the Edison and Swan Company, which, in respect of various characteristics in form, represents an electric incandescent lamp, but in method it operates with an arc. "Electrical Engineering" has lately called attention to another tungsten arc lamp, of American origin, which has been described at a joint meeting of the New York Section of the American Electrochemical and Illuminating Engineering Societies. It is desired that at present the description shall be taken merely as an account of the outcome of scientific research, without giving too much credit to it from the practical standpoint. The statement in our contemporary points out that a study of the light efficiency of an arc from a chemical standpoint shows that there is a certain rather limited class of substances which, when introduced into the arc in small quantities, produce a very great increase in luminosity. Thus the addition of small quantities of cerium or calcium compounds to the carbon arc may increase its efficiency over 300 per cent.; and the addition of titanium (preferably as an oxide) to the magnetic arc similarly produces an increased luminosity without a corresponding increase in energy consumption. But it is a peculiar coincidence that the addition of cerium or calcium to the magnetite arc, or of titanium to the carbon arc, does not result in approximately the same gain in efficiency. Consideration of these facts led to the conception that perhaps an arc could be maintained in a closed vessel, and be supplied with these light-producing elements in the vapour form. The lamp consists essentially of an arc chamber at the centre of which the arc is drawn between two tungsten electrodes about $\frac{3}{16}$ inch in diameter. The electrodes are partly surrounded with a refractory insulator, designed to prevent the arc from moving far from the ends of the electrodes. Tungsten was found to be the most satisfactory electrode material, as it is practically inert, even at a white heat, in the presence of various vapours. As all the liquids employed for supplying the active vapour are hygroscopic, and many of them readily decompose by ordinary moist air, it is necessary to exhaust the air from the lamp, heat the lamp and electrodes while at a low pressure in order to remove the air films, and then admit the liquids without opening the lamp chamber to the air. The appearance of the arc in the lamp is quite different from other commercial arc lamps. Among the vapours experimented with are antimony tetrachloride, carbon tetrachloride, stannic chloride, titanium tetrachloride, &c. The spectrum of the flame is usually quite different from the arc spectrum, and is characteristic of the elements involved, while the spectrum of the arc independent of the ends of the electrodes (which, of course, give a hot-body spectrum) is usually a band spectrum, and is practically continuous except for a few absorption lines. A curve indicates that a 4-inch arc at 10 amperes requires no more voltage than a 1-inch arc at 2 amperes. In other words, a 10-ampere arc is four times as long; in addition, its intrinsic brilliancy is about five times that of a 2-ampere arc; and, accordingly, the light emitted by a 10-ampere arc under these conditions is twenty times that of a 2-ampere arc. Since the wattage of a 10-ampere arc is only about five times that of the 2-ampere arc, the efficiency is approximately four times that of the latter. Efficiency curves indicate that approximately the point of maximum efficiency of this particular antimony pentachloride lamp is 20 amperes.

Society of British Gas Industries.—The Council announce that the Right. Hon. H. E. Duke, P.C., K.C., M.P., has accepted the presidency of the Society for the ensuing year, in succession to Sir Alfred Keogh, K.C.B.

THE BURDEN OF PITCH.

SOME PROMISE OF RELIEF.

By Thomas Glover, of Norwich.

Proprietors of coke-ovens and gas engineers—with the approval of their directors and municipal committees—are all endeavouring to adjust methods of manufacture in such a way as to increase the yield of benzol and toluol; but huge stocks of pitch at the present time are having a retarding effect on the production of these essentials for the manufacture of high explosives. To some gas engineers and all tar distillers the subject of pitch has become a real burden; and if new outlets can be found, much relief will be experienced and great benefits may result.

The gas industry of this country uses about 15,000,000 tons of coal per annum, 5 per cent. by weight of which, by the processes of carbonization and tar distillation, is converted into pitch. We get, therefore, a figure of 750,000 tons of pitch produced by the gas industry, to which we may add the quantity from the newer form of coke-ovens; and it is obvious that the total yearly production of pitch must exceed 1,000,000 tons. In pre-war days, the great bulk of this output was taken by Belgium and France for the manufacture of briquettes; and these conditions will doubtless obtain again when peace returns to Europe. The sudden closing of this market has brought us face to face with a serious situation.

British-Made Briquettes.

Now there are three ways in which the pitch position can be met. In the first place, there is the British-made briquette, which is of quite different shape and size from our old-fashioned notions of a briquette. It is so proportioned that it can be put on the domestic fire just like handy cobbles of coal, and produces quite a pleasant and lasting fire. Briquettes made to the old pattern form a dull, slow-burning, uninteresting mass; but briquettes such as I have in mind give, for a little time, a cheerful blaze, and when the pitch and creosote are exhausted throw out a fine radiant heat, like that of glowing coal. Briquettes of this kind are now being made at some gas-works; and I speak from personal experience when I say that they afford a highly satisfactory and clean looking fire.

It is unfortunate that in the manufacture of briquettes only 10 per cent. of pitch is required, mixed with 90 per cent. of fine coke breeze or coal slack. If the position was reversed, and 90 per cent. of pitch was needed, the proposition would be an attractive one from the point of view of absorbing pitch. It is, however, interesting to know that coke breeze can be employed in their manufacture; and it is stated that washed pan breeze, with 10 per cent. of pitch and some tar oils, will make exceedingly good briquettes. With the high price of coal now prevailing, it would appear to be of increasing importance to convert the pitch into some such convenient form of fuel as to enable its heat value to be realized.

The manufacture and sale of briquettes may provide a new sphere of usefulness and a source of revenue for gas undertakings; and by taking up the manufacture we should be turning to good account some portion of the pitch production.

As a Road Binder.

Another outlet for pitch may be found in its extended use as a road binder. It cannot be too strongly impressed on road authorities that pitch products will make thoroughly satisfactory bituminous binders for roads. One can only earnestly hope it is not true, as reported, that the money which motorists have contributed—by taxes on petrol, &c.—for the improvement and proper maintenance of the roads, is, at the present time, being disbursed by the Government for other purposes. It will be a matter adversely affecting the pitch position if this money is not to be available for the purpose for which it was raised. The road crusts in this country have been built-up during the last few years by surface tarring, and are in many cases extremely satisfactory; but they are only thin. They have been improved by the yearly application of tar and chippings; but if they are to be neglected for one year, this thin road crust will break through, and there is no road so unsatisfactory as one which is partly worn out and partly tarred. Those who have motored over such roads in various parts of the country are aware that this is the case. And there is another aspect. People who live in districts where the roads are made up with broken flintstone have found that they cannot travel on certain roads without being let-down; and when they get home and examine their spare wheels, they pull out sharp pieces of flint, which might have been specially designed to puncture tyres. It is scandalous that in these days roads should be patched with unrolled flint stones, or, indeed, that roads should be patched or re-surfaced with anything but tarred stone or stone grouted with a pitch binder.

Here is an outlet for pitch, if the road authorities will only do their duty, and see that a proper quantity is put on the roads.

Pitch for Gas Making.

But there is another direction in which we can help ourselves. It was originally suggested, I think, by the introduction into this country of pitch resulting from the distillation of petroleum oil. The hydrocarbons contained in this pitch are, for the most part, of the paraffin series; and it has proved a very rich material for gas-making purposes.

Bearing in mind what has just been mentioned, and reflecting

on this great burden of many thousands of tons of pitch, representing a large amount of dead-money to the gas and tar industries, it naturally occurred to me—as it has done to others—that if this paraffin pitch has been used for gas making with good results, what the effect would be of carbonizing a suitable proportion of coal-tar pitch mixed with coal. I therefore tried some experiments.

It will be found that, without any trouble ensuing, 5 per cent. of the pitch previously disintegrated, can be mixed with the coal as it is fed into the breaker or elevator, and passed into the hoppers. If the pitch were carbonized separately, a light, porous, honeycombed coke would be produced, as near pure carbon as possible, though not in the crystalline form of diamonds. I do not propose to make this pure pitch coke, though it might be useful for some very delicate metallurgical purposes. Satisfactory coke has resulted from tests of 5 per cent. of disintegrated pitch mixed with Yorkshire washed nuts. Another experiment with 10 per cent. of pitch mixed with coal nuts resulted in coke varying so little from the 5 per cent. mixture that it was hardly possible to distinguish one from the other. A trial was then made with a 20 per cent. mixture; and the coke was of rather more compact character. It was not honeycombed; the ingredients being so thoroughly mixed and fused in the process of carbonization that it was impossible to detect that pitch had been used. If tested for ash, of course, a reduction would be noticed, because pitch coke contains an extremely small quantity of ash.

Results of Experiments.

Unfortunately, with a depleted staff, experiments are difficult to carry out satisfactorily; and it is impracticable to confirm the results by repeating them as one would like to do. I am, however, able to give particulars of a trial working with a 5 per cent. addition of pitch to the coal. On a previous occasion, we worked 24 hours with 5 per cent. of coal deducted and 5 per cent. of pitch added, and for a similar period with 10 per cent. of the coal displaced with pitch. In the latter experiment, a little trouble was experienced with the upper parts of the ascension-pipes and by the thickening of the tar in the hydraulics. With 15 per cent., we got blocked pipes; but with 5 per cent. one can go on indefinitely without trouble, and it is being done at the Norwich Gas-Works from day to day. We are using up our own production, so that the burden of pitch does not exist for us.

Now, as to the results of the trial working at a small town gas-works—fitted as a test works—to which allusion has already been made. The report I have received states that on the first day there was normal working with charges of 2½ cwt. of coal per retort, and on the following day a similar charge of coal with the addition of 5 per cent., or 14 lbs., of pitch per charge. The heats were exceptionally good, and the working was with a fresh truck of coal just received. No trouble was experienced with the ascension-pipes, though a slight coating of lampblack was noticed on the mouthpieces and lids when the pitch was in use.

The gas results showed an additional make of 600 cubic feet from 126 lbs. of pitch, which is equal to 10,666 cubic feet per ton of pitch. There were 8½ lbs. more coke obtained from the charge; and this is equivalent to 12·14 cwt. per ton of pitch. All possible precautions were taken to ensure the coke being thoroughly dry before weighing; for it will be understood that even 1 lb. of water would make a vast difference to the results. From figures obtained in the laboratory, however, about 10 cwt. of coke per ton of pitch is the quantity expected.

The illuminating and calorific values were practically the same in each case; the gas being of good quality throughout. These particulars are from a brief report by the chemist in charge of the test works, who then goes on to give figures which show that he was making at the time 12,035 cubic feet per ton from the coal alone; and with the coal and pitch, of course, the make went down slightly, to 11,970 cubic feet.

From what has been said here, I feel we are justified in believing that our pitch will make gas. I am, of course, speaking of Norwich pitch. It is impossible for me to say what other pitch will do. Some people say that pitch derived from tar produced at certain works is inert, and contains an undue percentage of free carbon. But our results are sufficient to encourage managers of gas undertakings to relieve the position by each taking his own equivalent of pitch from the tar distiller, who has been saying, "I cannot pay for your tar, because I cannot sell the pitch."

If tar is being sold on the sliding-scale based on the products it contains and their market values, a works taking its proportion of pitch will get a fair price for the tar. If tar distillers agree to sell at 15s. per ton of pitch, I think the equivalent in other products will be realized, and a reasonable price obtained for the tar. If, however, the price be fixed at 20s. to 30s. per ton, gas undertakings purchasing pitch for carbonization will realize its value partly in the improved price obtained for the tar, and partly in the value of gas and other products. Thus the whole transaction will become automatic, and the great burden of pitch will be lifted.

The Coke-Works Point of View.

So far, I have only discussed the matter from the gas engineer's and tar distiller's point of view. The coke-works manager, however, may take an important part in this beneficial movement; and probably greater direct benefits accrue in the case of coke-oven products and in the financial results of working, than in those of a gas-works.

The compactness and metallic texture of the coke from ovens is principally due to the carbonized tarry matter and the prolonged period of exposure to carbonizing temperature to which the heavy charges are subjected. Lean coals, even when compressed by stamping, produce less satisfactory coke than coals rich in resinous and hydrocarbonaceous matter. A suitable percentage of disintegrated pitch added to such coals would produce a denser, purer, and more valuable metallurgical coke. It may be remembered by some who by chance read these notes that a coking process was in use at one of the large iron-works in the Black Country for some years, for producing from the non-coking South Staffordshire coals coke suitable for use in blast-furnaces. The South Staffordshire coals are particularly deficient in resinous matter; but this defect was compensated for by the addition of ordinary coal-tar pitch, with, I believe, satisfactory results.

There is every reason to believe that pitch could be used with advantage in large quantities at the coke-ovens. An experiment already made in the North-East Coalfield gives one confidence in recommending the matter to the serious consideration of coke-oven managers.

Experimental Carbonization at a Gas-Works.

The following are the figures relating to the experimental carbonization of coal and coal and pitch at the experimental works to which I have referred:

—	Normal Working	5 Per Cent. Pitch.
Gas made	13,540 cub. ft.	14,140 cub. ft.
Coal used	22½ cwt.	22½ cwt.
Pitch used	—	1⅛ cwt.
Gas made per ton of coal	12,035 cub. ft.	—
,, ,, coal and pitch	—	11,970 cub. ft.

Additional gas made by 1⅛ cwt. of pitch . . . . 600 cubic feet.
Equivalent to 10,666 cubic feet per ton of pitch.

Weight of coke from charge	192½ lbs. Equal to 13·75 cwt. per ton of coal.	201 lbs. Equal to 13·67 cwt. per ton of coal and pitch.

14 lbs. of pitch yield 8½ lbs. of coke, or 1 ton of pitch yields 12·14 cwt. of coke.

Calorific Values—B.Th.U. Net.

Sighest observed	595·83	588·03
Lowest observed	541·89	545·85
Hample collected over six hours	565·85	561·18

Illuminating Power.—Candles.

Highest observed	21·5	22
Lowest observed	17	17
Sample collected over six hours	18·25	18·25

Benzene and Toluene in Gas per 12,000 Cubic Feet.

Crude naphtha to 145° C.	2·64 galls.	2·69 galls.
,, ,, 145 to 170° C.	0·117 galls.	0·124 galls.
Benzene	17·33 lbs.	17·68 lbs.
Toluene	2·96 lbs.	2·82 lbs.

Proximate Analysis of Pitch.

Volatile matter	51·2 per cent.	Ash in pitch	1·1 per cent.
Coke	48·8 ,,	Ash in pitch coke	2·25 ,,
Sulphur in pitch coke	0·178 per cent.		

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

A Meeting of members of the Association—the busy time of the year and other unpropitious circumstances were responsible for a smaller attendance than usual—was held on Friday evening at the Westminster Technical Institute, Vincent Square, S.W., when a paper, which was illustrated by lantern slides, was read by Mr. E. Stroud, of Holophane Limited. The paper was on the subject of "Modern Illumination as Applied to Gas Lighting"; and the main portions of it, with some notes of the discussion to which it gave rise, will be found on pp. 260-62 of this issue.

At the opening of the proceedings, the President (Mr. S. B. Chandler, of the South Suburban Gas Company) remarked that it had been thought proper that a letter should be addressed, on behalf of the Association, to Mr. G. M. Gill congratulating him on his appointment as Chief Engineer of the South Metropolitan Gas Company. In reply, Mr. Gill had expressed his thanks to the Council and members for their good wishes, and had stated that anything he could at any time do for the Association would be a pleasure to him.

SULPHATE OF AMMONIA SUPPLIES AND EXPORT LICENCES.

Suspension of Licences—Farmers Urged to Buy Early and Largely.

LAST week the Board of Agriculture issued the following statement regarding sulphate of ammonia supplies and exports:

In view of the uncertainty as to the sufficiency of the supplies of sulphate of ammonia to meet the home demands during the next few months, it has been decided, on the recommendation of the Fertilizers Committee, with the approval of the President of the Board of Agriculture and Fisheries, and the President of the Board of Trade, to suspend for the present the issue of licences for the export of sulphate of ammonia.

Under normal conditions, it is well known that the production of sulphate of ammonia considerably exceeds home requirements, but Lord Selborne confidently hopes that farmers will this year greatly increase their demands for fertilizers of all descriptions so as to stimulate, so far as practicable, the production from the land, and thus reduce the importation of foodstuffs. This stimulus is the more necessary to counterbalance in some degree the hindrances to production arising from shortage of labour and other causes.

Lord Selborne therefore appeals to farmers generally to justify his belief in their enterprise and patriotism by availing themselves of the opportunity now provided to secure plentiful supplies of fertilizers. Farmers are especially urged to place their orders for sulphate of ammonia at once, so as to enable the expected increased demand to be met without undue delay or difficulty.

LETTER FROM THE SULPHATE OF AMMONIA ASSOCIATION.

In connection with a letter addressed by the Board of Agriculture to sulphate of ammonia makers—it also touches the questions treated upon in the foregoing notification—the Sulphate of Ammonia Association have addressed the following letter (signed by the Chairman, Mr. D. Milne Watson), to producers:

Available Supplies and Licences.

You will have received a long letter from the Board of Agriculture with reference to the present position; and, as the Board refer to us, we think it desirable to make a few comments.

We may say that we realized some three months ago that the present difficulty was likely to arise; and we then approached the Government and asked them to take steps to obtain information relative to the production and probable consumption of this article in the spring, together with returns from export merchants showing what quantities had already been sold to foreign countries. Our object was to enable the Government to make as accurate a forecast as possible of requirements and supplies, and thus determine in advance what quantity would be available for export each month. Our idea was that export licences should then be granted at the beginning of each month for the estimated surplus, and that further licences should be issued towards the end of the month if the surplus turned out to be greater than was anticipated. This plan would have enabled the whole question to be dealt with in a scientific and businesslike manner; and as the Government has in its possession information regarding the quantities already sold to overseas countries, it would have been perfectly easy to allocate the export licences granted in proportion to the purchases made by each country, giving such preference to our Allies as was deemed necessary.

We regret that, in spite of the fact that they have all the information, the Government apparently do not intend to make such use of it as we have above indicated. They apparently assume that the normal home demand will be nearly trebled, and are only granting at present applications for export licences made before a certain date, although this will necessarily involve injustice to some of our overseas customers. This result is disappointing; but we think we have succeeded in convincing all departments concerned that it is absolutely necessary that manufacturers of sulphate of ammonia should obtain a regular outlet for their production, so that, if the home demand proves insufficient to keep the works clear, further licences for export will undoubtedly be granted.

We notice that the Board of Agriculture ask you to make returns on the 1st and 15th of each month, showing the position of your stocks. In view of the very great difficulty in shipping sulphate of ammonia at the present time, it is desirable that licences should be available before the storage accommodation at the works is absolutely exhausted, for an interval of probably at least fourteen days will elapse between the issuing of the licence and the possibility of shipping. We would therefore recommend you to advise the Board of Agriculture immediately there is any danger of your works becoming overstocked.

Price Agreement and Sulphuric Acid.

There is another matter on which we wish to say a few words. When we agreed to sell to farmers during November-December at £14 10s., Mr. Acland, of the Board of Agriculture, distinctly informed us, at one of the meetings of our Committee, that the Government would not interfere with the price of sulphate of ammonia in the spring. In spite of that, and in spite of the fact that we of our own accord suggested to manufacturers at the end of December to limit the price of sulphate of ammonia for home use for the spring, the Board of Agriculture have endeavoured by every possible means to induce us to agree to a still lower price. We so far yielded to their representations as to suggest to manufacturers to limit the home price to a maximum of £16 15s., in bags at works, net cash; but we made it clear to the Board that this offer was conditional on the Government taking the necessary steps to provide sulphuric acid at a reasonable price.

We understand that a Committee was appointed by the Ministry of Munitions to deal with the acid question, and that this Committee has now reported. But we gather that the Government still shrink from taking the necessary steps to control acid manufacturers, and that nothing further will be done unless overwhelming pressure is brought to bear on the Government. We have sufficient first-hand evidence in our possession to show that acid manufacturers are taking advantage of the shortage of supplies in a scandalous manner. We therefore advise you, in case you are not able to obtain supplies at a reasonable price, to write to the Ministry of Munitions, Storey's Gate, Westminster, enclosing a copy of your letter to the Rt. Hon. F. D. Acland, M.P., Board of Agriculture, No. 3, St. James's Square, S.W., requesting the Government effectively to reduce and limit the price of acid.

Stimulating Local Demand.

Finally, we notice that the Board of Agriculture ask you to state what steps you have taken to stimulate the use of sulphate of ammonia by farmers. Those who are members of this Association can answer that question sufficiently by simply stating that fact; and we would suggest to those who are not members that they can most easily answer the question by joining the Association immediately.

We may say that within the last fortnight we have distributed some 400,000 leaflets to farmers, and that we are conducting a most energetic campaign, and spending a large sum of money on advertising in the Press. Further, we are sparing no effort to put country dealers and other users into touch with suppliers, and generally to facilitate trade in our product.

PUBLICITY AND EDUCATIONAL WORK OF THE ASSOCIATION.

The information conveyed in the last two paragraphs of the foregoing letter is important. It shows that the Association are actively at work not only trying to enlarge the home demand for sulphate of ammonia, but to do what the Government are anxious should be done—help to intensify the cultivation and production of foodstuffs. The publicity work of the Association covers a large field—in fact, the functions of the organization in this respect are exercised generously yet judiciously and systematically. We have some specimens of excellent block advertisements the truly rural landscapes presented in which show in most commanding manner the values of sulphate of ammonia. In one of the advertisements, too, the sun and a couple of gasholders form the background to a view in which the representation of the sulphate of ammonia raised crops must make every farmer wish that his own soil was as productive of wealth. These advertisements appear in the "Journal of the Board of Agriculture," "Agricultural Gazette," "Country Gentlemen's Estate Book," "Country Life," "Farmer and Stockbreeder," "Fertiliser and Feeding Stuffs Press," "Farm Life," and "Field." Advertising in other agricultural papers is also to be undertaken shortly.

In regard to literature, too, the Association are very successful. They have brought out in quite tasteful form a new and revised edition of their pamphlet "The Manure Richest in Nitrogen." The printing on the cover is symbolic of a golden harvest and golden returns. Another illustrated pamphlet entitled "Luxurious Growth" is now in the press. Some 400,000 of a circular "To Farmers" were printed, of which about 310,000 have been distributed in lots of 100 copies among some 3100 manure dealers throughout the United Kingdom, with the request that they will circulate them among their customers. About 60,000 have been sent to sulphate of ammonia manufacturers throughout the United Kingdom for local distribution among farmers, and some 10,000 are being distributed from the head office.

As to prize competitions, money prizes amounting to £250 are being offered for the best crops of mangels, swedes, potatoes, and ox cabbage grown with the aid of sulphate of ammonia.

Field experiments are being continued throughout the United Kingdom, under the supervision of the Association's eleven District Supervisors, but on a restricted scale, owing to the reluctance of many farmers to undertake the experiments in consequence of the shortage of labour and other causes due to the war. Mr. Leighton (who is very active in the propaganda branch) has instructed the Supervisors to devote as much time as possible during the next few months to ascertaining manure dealers' spring requirements of sulphate of ammonia, and to assist them in every way in obtaining supplies locally. This information shows that during war time, as in peace time, the Committee of the Sulphate of Ammonia Association are looking after every opportunity for enlarging demand.

"ESCAPES" OF COAL GAS, AND THEIR EFFECT AS REGARDS INJURY TO HEALTH.

A PROMINENT feature in the case of *Lockyear v. Kingsclere Guardians*, which was taken at the Berkshire Winter Assizes on Jan. 13 and 14 [*ante*, p. 157], was the conflicting nature of the evidence bearing on the material facts, in respect to which more than one of the witnesses decidedly contradicted their own statements. The explanation may be that the incidents on which the claim of the plaintiff was based were passed over as ordinary occurrences of no special importance at the time, and that they happened in November, 1913—fourteen months ago. Probably nothing in the way of evidence or cross-examination, in connection with them, was then anticipated. All this is very interesting

to those who care to follow the intricacies of legal proceedings, but has no special association with the gas indnstry.

So much cannot be said, however, in respect of the evidence tendered by Professor H. Wilson Hake, of the Westminster Hospital Medical School, as to the effect of an "escape" of gas in relation to the health of the occupants of a room in which it occurs, especially in view of the fact that gross exaggeration and misrepresentation are prevalent on the very important matter of the "wholesomeness," or otherwise, of a free use of gas in the home or workshop. Our readers have frequently heard (from their customers) of assertions to the effect that where there are gas-pipes there is also leakage, and that where there is leakage there must, of necessity, be injury to health. Or admitting that, by unusual good luck, the pipes and fittings may be perfectly sound, the consumers' attention is directed to the length of pipe between the tap and burner in an ordinary bracket or pendant, which may be (say) 12 inches. When the gas is shut off, after use, it is said that this run of pipe is full of gas, all of which may escape into the atmosphere by transpiration from the nipple of the burner, as proved by the fact that if the gas is turned on after some hours, a quantity of air is displaced before the gas can be ignited. The material facts that the quantity of gas concerned is infinitesimal, and that the specific gravity of gas, as compared with air, ensures the rapid progress of escaping gas towards the ceiling, are evaded or glossed over; while at the same time the poisonous qualities of carbon monoxide are rushed for all they are worth. Working on these lines, an ingenious canvasser can construct a plausible argument for bridging-over the objection due to the difference in cost as between gas and electricity.

The most important question in connection with poisons of any kind is the quantity required, not necessarily to cause death or dangerous symptoms, but to occasion unpleasantness or discomfort, perhaps of only a temporary character. If the poison is in the form of a gas, Nature provides a most effective protection, in respect to gases that affect the sense of smell, which includes all kinds of "town" gas. Many persons, in the course of their daily employment or otherwise, habitually imbibe poisons of various kinds, but in quantities below the limit above indicated, without the slightest apparent ill-effect; and the specially notable feature of Professor Hake's evidence is that it deals with the question of the limit of safety. Our interest is enhanced by the fact that he avoids scientific language or formula, and presents his deduction in a common-sense form, readily understandable.

In the course of a description of the room in which the poisoning was alleged to have taken place, the evidence showed that it was a fair-sized apartment of some 3000 cubic feet content, having two doors on opposite sides of the room (both in regular and frequent use), two windows that could be open if desired, and a fire-grate with chimney, in which a fire was regularly maintained, when necessary, all of which would tend to ensure excellent ventilation. The only gas-fitting in the room was a single pendant light, with cup-and-ball joint, and a flat-flame burner. The supply consisted of "straight" coal gas, in which the only active poison ous ingredient, as generally agreed among toxicologists, is carbon monoxide, which would, in these circumstances, be present in the gas to the extent of about 6 per cent. Professor Haldane has shown that an atmosphere containing one part in 2000 of carbon monoxide might occasion toxic symptoms, that with one part in 500 the symptoms would be urgent, and that about one part in 100 must be regarded as fatal.

Working on these simple data, Professor Hake proceeded to consider the effect of an imaginary escape of gas in the room. A leakage to the extent of 1·5 cubic feet would be the minimum quantity required to produce an atmosphere containing one part of carbon monoxide in 2000; and some considerable time would elapse before the gas could by any possibility be uniformly diffused, since coal gas is lighter than air, and with fair ventilation much of it would be carried away by draught. To obtain an atmosphere of one part in 500, at least 6 cubic feet of gas must escape. A leakage to the extent of only 1·5 cubic feet would produce an odour extremely perceptible to any individual accustomed to the use of gas. An ordinary flat-flame burner, consuming 5 cubic feet of gas per hour, would need to be turned on full (unlit) for 18 minutes to produce such a result. A similar burner would have to be turned full on for 72 minutes before 6 cubic feet of gas could escape. A leakage to anything like this quantity would produce such a pronounced odour as to cause great alarm, on account of the general fear of explosion. The odour of coal gas is perceptible when it is present in the air to the extent of only one part in 10,000; and in the course of a long experience in the use of gas apparatus, he had frequently noticed the very perceptible odour produced when the gas was turned on only for a few seconds. Under the conditions he had named, it would be impossible to obtain a toxic atmosphere by admixture of coal gas, without warning of a very obvious character to persons who were awake and using the room; and most people, in the event of an escape of gas, would take some action towards investigation and location of the same, or would direct attention to it and call some one into the room to verify it. As regards ordinary cases of persons being affected by coal gas, it usually happens that the victims were occupying a bedroom, and asleep, during the period when, by reason of some escape of gas, the atmosphere became contaminated in a continuously increasing degree. A person not asleep may feel the gradual approach of lassitude, semi unconsciousness, or other unfamiliar symptoms, in time to rescue himself. The plaintiff, being on night duty, and obviously not asleep or undressed, would not be occupying the room continuously, but be moving in and out in the course of the night.

After remarking on some of the symptoms described by the plaintiff, Professor Hake stated that in severe cases of poisoning by carbon monoxide or coal gas, the onset of symptoms is somewhat rapid. There is no pain in the first instance, but there may be a preliminary period of excitation akin to intoxication, and often of a pleasurable character, followed by a sense of heaviness in the head, dizziness, noises in the ears, accelerated cardiac and respiratory movements, oppression on the chest, and consequently vomiting. Along with these symptoms, muscular weakness ensues, followed by drowsiness, coma, or death, if the patient is not rapidly removed from the toxic atmosphere and has not undergone too long an exposure. Treatment by means of oxygen, or artificial respiration, or stimulants, is usually resorted to. If the patient recovers, after acute poisoning, among the after-effects may be specially noted severe headache, occasional palpitations, occasional seizures rather in the form of an epileptiform fit than of fainting, and sometimes temporary loss of power in the legs. These after-effects may occur every few days, and they sometimes continue for weeks at intervals; but, as a general rule, when recovery has occurred they pass away and leave the patient normal, nor do they seriously interfere with ordinary occupation.

Professor Hake also referred to a report by the late Sir Clement Le Neve Foster, F.R.S., one of His Majesty's Inspectors of Mines, on the effect of carbon monoxide in connection with an underground fire at Snaefell Mine, Isle of Man, in 1897, in which the effect upon himself and others of acute poisoning by the vitiated atmosphere is minutely described. In this accident, twenty miners were overcome and died from the effects of carbon monoxide poisoning, in an atmosphere shown by the analysis of Dr. Haldane to contain slightly over 1 per cent. of this gas. Sir Clement Le Neve Foster, his Assistant, Mr. Williams, and about four others, while engaged in rescue work and investigation of the accident, were suddenly overcome by the poisoned air and rendered unconscious. They had to be hauled up to the surface from a depth of 100 feet. They suffered no pain at the time of being overcome, but began to feel ill shortly after, and were at first dazed and semi-conscious. The after-effects were such as those already mentioned; but although they were rescued from certain death, they all recovered, and apparently were not seriously prevented from continuing their various activities.

Having referred to the symptoms of carbon monoxide poisoning at some length, in order to emphasize their marked character, Professor Hake observed that none of these were specifically put forward in the plaintiff's claim, and that it was clearly evidenced that she did not and could not have suffered from acute poisoning by inhalation of coal gas. He also dealt with chronic poisoning by coal gas, or carbon monoxide, as brought about by long and continued exposure to an atmosphere containing smaller proportions of these gases; and he showed that the plaintiff's symptoms were in no way compatible with this form of poisoning.

There is one point in connection with Professor Hake's evidence to which attention should be directed. The authorities on which he relies deal with neat carbon monoxide and not with a coal gas containing 6 per cent. of this compound; and there must be a marked distinction, as regards toxic effect, between the two. In his calculations, he treats the coal gas as being equivalent to pure carbon monoxide. For instance, he speaks of 1·5 cubic feet of gas being required to give an atmosphere containing one part in 2000 of carbon monoxide, whereas it is evident that sixteen times this quantity would be necessary to secure such a result. As compared with pure carbon monoxide, there must be a very substantial margin in favour of a coal gas containing only 6 per cent. of this compound; the remainder being composed of comparatively innocuous gases. The evidence is therefore largely on the safe side, not only in respect to coal gas, but also to carburetted water gas in any proportion. Whether the gas supply is "straight" or "mixed," it is conclusively proved that, in the absence of extraordinary or criminal negligence, no risk or danger can by any possibility attend the use of town gas, by reason of unpreventable or non-evident escapes in the consumer's supply pipes or fittings.

German Iron Coinage and Prepayment Meters.

A report from the Central Gas Publicity Bureau of Berlin, in the "Journal für Gasbeleuchtung" of the 15th ult., points out that the German Imperial Bank has taken great care that the small iron coins which have been issued to replace the nickel coins that have been called in on account of the nickel being required for munition manufacture, shall be serviceable in prepayment meters designed for the use of the nickel coins. It would appear that five pfennige pieces [about ½d.] of iron have been longer in use than iron ten pfennige pieces. The iron coins are Sherardized to protect them from rusting. The five pfennige iron pieces are of the same weight as the nickel coins which they replace, but are rather thicker and have milled edges. The ten pfennige iron pieces, on the other hand, are exactly the same size as the former nickel coins of the same value, and, like them, have smooth edges. The Bureau states that it has proved by trial that the new coins operate quite satisfactorily all the types of ten-pfennige prepayment meters in use, and that the users of these meters (which number over 1¼ millions in Germany) will find that they can continue to obtain supplies of gas with the same facility as hitherto, notwithstanding the change of coinage.

THE UTILIZATION OF ENERGY FROM COAL.

By Professor WILLIAM A. BONE, D.Sc., Ph.D., F.R.S.

The second of a series of three lectures on the above subject, by Dr. WILLIAM A. BONE, F.R.S., Professor of Chemical Technology at the Imperial College of Science and Technology, was delivered at the Royal Institution last Thursday. The first lecture appeared in the "JOURNAL" last week (pp. 206-208), and the third, and final, one will be delivered next Thursday.

FUEL ECONOMY FROM A NATIONAL STANDPOINT.

The national aspects of fuel economy may be considered from two somewhat different standpoints—namely: (1) In view of the economic situation created by the war, and the necessity of enforcing a policy of national economy in the utilization of essential commodities as the best means of paying a colossal war debt; and (2) in view of the interests of that remoter, but nevertheless not far distant, future, when our coal supplies will be restricted by approaching exhaustion.

It can hardly be questioned that the chief material basis of the great industrial and commercial expansion of this country during the past century has been our abundant supplies of easily obtainable coal, which, until quite recent years, have given us a position of great advantage over all other countries. It is also equally true that we can no longer claim any advantage in this respect over our two nearest competitors, and that our whole economic future is dependent on our ability to maintain abundant supplies of relatively cheap fnel, which, in turn, is limited by the probable duration of our easily workable coal seams in relation to present and future demands. In order that we may the more clearly apprehend the grave national importance of the coal question at this crisis in our history, I will attempt a brief statistical survey of the world's coal resources, and the relation of the principal coal-producing countries thereto.

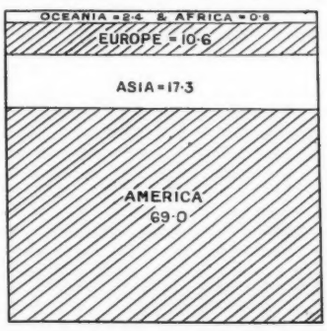
THE WORLD'S COAL RESOURCES.

According to an exhaustive and very illuminating report upon the World's Coal Resources issued by the International Geological Congress in 1913, the total probable and possible reserves of coal of all kinds (including anthracites, bituminous coals, and lignites) available within 6000 feet of the earth's surface, are estimated to be 7,397,553 million metric tons; or, approximately, 6000 times the present total annual consumption. Therefore, the world as a whole need have no fear of any speedy exhaustion of its coal supplies.

World's Estimated Reserves of Coal, 1913, 7,397,553 Million Tons.

Of the estimated total reserves, 6·75 per cent. are anthracites (mainly located in China), 52·75 per cent. are bituminous coals, 40·5 per cent. belong to the less valuable sub-bituminous class, which includes all the lignites and tertiary brown coals.

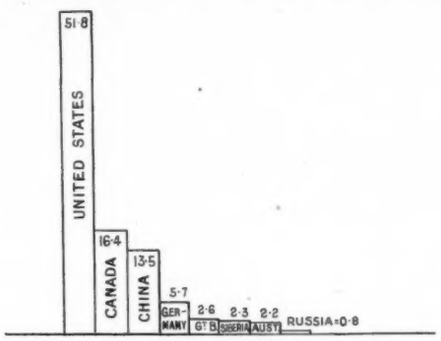
A survey of the geographical distribution of the estimated reserves should cause the belligerent powers of Europe to recognize the folly of the present wholesale destruction of human life and accumulated wealth, for no less than 69 per cent. of the total are located in America (almost wholly North America), 17·3 per cent.



Percentages of World's Total Coal Reserves.

in Asia, 10·6 per cent. in Europe, 2·4 per cent. in Oceania, and only 0·8 per cent. in Africa. It is a significant fact that the two tropical Continents of South America and Africa are practically destitute of coalfields of any economic importance. The future wealthy republics of South America must continue, as heretofore, to import coal, machinery, and heavy manufactured goods, in exchange for agricultural produce and raw materials.

Pursuing the matter a little further, we find that of the total estimated reserves, 51·8 per cent. are located in the United States, 16·4 per cent. in Canada, 13·5 per cent. in China, 5·7 per cent. in Germany, 2·6 per cent. in Great Britain, 2·4 per cent. in Siberia, 2·2 per cent. in Australia, and only 0·8 per cent. in Russia. I think that China's resources have probably been considerably under-estimated; and I should be inclined to place China second to the United States. Otherwise the relative positions of the remaining countries are probably substantially as stated. It is, therefore, not difficult to foresee where, in the not far distant



Percentages of World's Total Coal Reserves.

future, when Europe's coal supplies approach exhaustion, the world's chief centres of manufacturing industry will be located. By that time the Chinaman, with his simpler standard of living and infinite capacity for patience and industry, will have learnt all he needs about western technical methods to make him the most formidable competitor of the white races; while the surplus population of Europe, or as much of it as is economically worth preserving, will have migrated to North America, where it is to be hoped, for the sake of freedom and humanity, the Anglo-Saxon race will always continue as predominant as it is to-day.

The world's demands for coal are increasing rapidly year by year. Thus, in 1903, they were 800,000,000 tons; five years later—that is, in 1908—they had increased to about 1,000,000,000 tons; and by the year 1913 they amounted to no less than

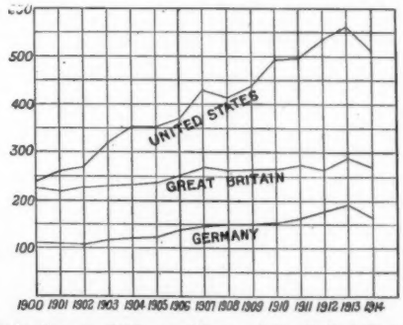
World's Output of Coals—Millions of Tons.

—	1903.	Per Cent.		1908.	Per Cent.		1913.	Per Cent.	
United States	319·5	40·0	83·4	415·8	41·5	82·3	562·6	45·0	83·3
Great Britain	230·4	28·8		261·5	26·0		287·4	23·0	
Germany	116·6	14·6		148·6	14·8		191·5	15·3	
France	34·3	4·3		36·8	3·7		40·1	3·2	
Belgium	23·8	3·0		23·7	2·3		22·8	1·8	
Russia	16·5	2·0		29·4	2·9		28·8	2·3	
British Possessions	26·5	3·3		42·0	4·2		50·0	4 0	
All Other Countries	32·4	4·0		43·2	4·3		66·8	5·4	
Total	800·0	100·0		1000·0	100·0		1250·0	100·0	

1,250,000,000 tons. This represents a continuous increase over a ten-years period, at a "compound interest" rate, of nearly 5 per cent. per annum, which rate is hardly likely to diminish after the conclusion of the present war.

Inasmuch as the world's demands have, during the period in question, been principally supplied by three countries—namely, the United States, Great Britain, and Germany—which between them have annually raised practically 83 per cent. of the coal consumed in the world, we may now concentrate our attention upon the statistics for these countries.

In the next diagram are plotted the annual outputs of anthracite and bituminous coals (lignite and brown coals have been excluded



Coal Production, in Millions of Tons, of the United States, Great Britain, and Germany—1900 to 1914.

because of their relative unimportance, although Germany annually raises large quantities of brown coal for consumption) of the three countries for each of the fifteen years 1900 to 1914 inclusive. Excluding the outputs for the last of these years, all of which showed a sharp decline owing to industrial dislocation subsequent upon the outbreak of the war, and the year 1912 for the British output, which was affected by the great coal strike, the outputs of all three countries, and particularly those of the United States and Germany, showed a progressive increase over the whole period.

If, now, the average annual outputs for each of the three successive quinquennial periods included in the fifteen years survey be taken, the following figures are obtained, which indicate that the output of the United States is increasing annually at a "compound interest" rate of 6 per cent., that of Germany at a compound rate of 4 per cent,, while the British output is increasing at a compound rate of only 2 per cent. Assuming that these relative rates of increase are maintained after the war, it may be predicted that Germany's output of coal will overtake that of Great Britain about twenty years hence, when each country will be producing some 420,000,000 tons per annum. Although Germany's known reserves of coal are at present more than double ours, it may be doubted whether they will long outlast ours—assuming always that the present ratios between the annual percentage increases in the two outputs are maintained during the next fifty years (which is quite possible), but which will probably depend largely upon the magnitudes of the respective export trades of the two countries. In this respect, however, we have great advantages over Germany.

Coal Productions of the United States, Great Britain, and Germany—Quinquennial Averages 1900 *to* 1914*—Millions of Tons per Annum.*

	United States.	Great Britain.	Germany.
1900–04	288·2	226·8	112·5
1905–09	400·5	256·0	139·8
1910–14	519·2	269·9	168·7
Approximate percentage compound interest increase	6·0	2·0	4·0

The question of our coal export trade is one upon which much has been written from opposite standpoints. Some people view its rapid increase with feelings of concern, if not alarm, because they regard it as depleting, for the benefit of foreign countries, a national reserve of irreplaceable material, at the expense of future internal development; while others, who are perhaps more directly interested, regard it as a present source of wealth, the exploitation of which is indispensable to the maintenance of our position as the leading maritime and financial power. Without entering into any argument for or against either of the two opposite views, I may perhaps venture to put before you a few of the leading facts which must be taken into account in formulating any opinion or decision upon the question.

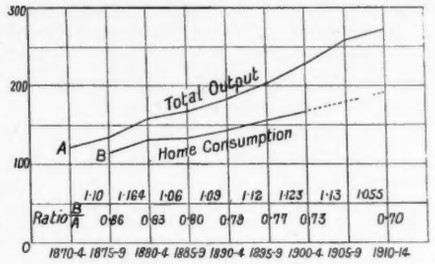
During the past sixty years our coal export trade has increased something like twenty-fold, both as regards the quantities and the values of coal exported. Moreover, its value relative to other values exported has, during the same period, increased four-fold, until to-day it constitutes about 10 per cent. of our total exported values. Thus in the year 1913, we exported 97·7 million tons, or 34 per cent. of our total output, valued at £53,000,000.

Another feature of our export trade is that whereas both the United States and Germany export considerable quantities of coal by land, their oversea exports are trifling compared with ours, and that in the year 1912 we actually transacted over 70 per cent. of the whole sea-borne coal trade of the world. Several factors have contributed to this astonishing result. One is the proximity of our finest steam coal seams to our ports, notably so the South Wales coalfield, which now exports more than 60 per cent. of its total output; another is the increased demands for coal from Europe and South America; while a third factor has been the phenomenal growth of our mercantile marine, which for successful competition with foreign tonnage depends upon good outward as well as inward cargoes. Inasmuch as the inward cargoes are chiefly foodstuffs and raw materials of considerable bulk in relation to their values, while our exports (except coal) are chiefly machinery and manufactured articles whose bulk is small in relation to their value, our shipowners are in a position to offer low freights for outward coal cargoes. Hence maritime supremacy and a large coal export trade are interdependent; and it is difficult to see how to restrict one without detriment to the other. Therefore, we must not expect any decline in our coal export trade, but rather the reverse, within the next half century.

Coal Production in Great Britain—Quinquennial Averages 1870 *to* 1914*—Millions of Tons per Annum.*

Period.	Average Output.	Calculated at 2 per Cent. Compound Interest.
1870–74	121·5	121·5
1875–79	134·0	131·1
1880–84	156·0	148·1
1885–89	165·0	163·5
1890–94	180·0	180·5
1895–99	202·0	199·3
1900–04	227·0	220·1
1905–09	256·0	243·0
1910–14	270·0	268·2

I will now ask you to consider a series of figures which I have prepared showing quinquennial averages, in millions of tons per annum, of the total coal raised in Great Britain between the years 1870 and 1914 inclusive, that is to say over a period of 45 years, which show how closely the continuous increase in production during that long period has followed a 2 per cent. compound interest law. These averages are shown as a curve in the next



Great Britain, Coal Production. Quinquennial Averages. Millions of Tons per Annum.

diagram, which also indicates the proportion of the whole production which has been retained for home consumption; while a third table shows that there has been a slight, but continuous, increase in the amount of coal consumed per head of the population during the past fifty years.

Duration of British Coal Supplies.

Much has been written concerning the probable duration of British coal supplies; and I do not purpose to do more than touch upon the matter this afternoon. It has formed the subject of investigation by two Royal Commissions. The first one was appointed in consequence of the publication of the late Professor Jevons' great book on the Coal Question in 1865, and reported in 1871; and the second issued its report as recently as 1905. Since that date, however, Dr. Strahan, the Director of the Geological Survey, has published, in the report of the International Geological Congress in 1913, a revised estimate; and more recently still (1915), Professor H. Stanley Jevons, following up his father's work, has published another estimate in his remarkable book on the "British Coal Trade."

Estimates of Reserves of British Coal within 4000 *Feet of the Surface.*

	Million Tons.
First Royal Commission, 1871	146,480
Second Royal Commission, 1905	141,635
Dr. A. Strahan, 1912	178,727
Mr. H. S. Jevons, 1915	197,000

In making such an estimate, it is necessary to consider two overruling factors: (1) The maximum depth at which it is practicable to conduct mining operations; and (2) the minimum thickness of seams which can be profitably worked. The first of these factors is determined principally by the increase in temperature as we descend into the bowels of the earth. In this country the temperature at 50 feet below the surface is constant all the year round at 50° Fahr., and then it increases 1° Fahr. for every 60 feet lower in depth. Both Royal Commissions adopted 4000 feet as the maximum limit of practicable working, at which depth the temperature might be expected to be 116° Fahr. (the deepest mine in Great Britain equals 3500 feet, in Belgium 3773 feet), and 1 foot as the minimum workable thickness of seam. The 1905 Royal Commission reported that our reserves of coal within the said limits then amounted to 141,635,000,000 tons; but their estimate was certainly conservative, and did not, for example, include the Kent coalfield and other concealed measures. Dr. Strahan's more recent estimate for the same limits, which included the Kent coalfield and other items, was 178,727,000,000 tons; while Professor H. S. Jevons, who considers that Dr. Strahan erred if anything on the safe side, gives 197,000,000,000 tons as a maximum quantity within 4000 feet from the surface. Adopting this as an outside estimate, and deducting 15 per cent. on account of "pit wastage"—*i.e.*, coal which is left for one reason or another in the workings—we obtain a new figure for actually available coal at the surface of (say) 168,000,000,000 tons, or (say) 580 times our present annual output.

The serious aspect, however, of the local coal question for Great Britain is not how long can our reserves possibly last, having regard to the probable long continuation of the present upward tendency of our annual outputs—which is, after all, only an academic question—but how long we can continue to get the available coal at a cost which will not place us as a nation at a disadvantage relative to our nearest competitors.* From this point of view, the achievement of all possible economies, not only in the getting but also in the transporting and utilization of coal, is of the greatest possible importance, especially in view of the heavy burdens which war taxation must inevitably impose upon commerce and industry. I will therefore invite you to consider with me the immediately important question of how far we are now making the best use of the coal which we annually consume, and in what directions we may expect to realize much needed economies, either by the adoption of improved methods or by the

* The average price of coal at the pit head increased during the period 1897-1910 by no less than 38 per cent.

better control or supervision of existing ones. For it cannot too often be insisted that the true line of economy lies not so much in the direction of imposing artificial restrictions upon either exports or domestic supplies, as in an insistance upon the coal raised being utilized to the best and fullest advantage by every class of consumer.

Beilby's Analysis of Coal Consumption in the United Kingdom.

		Million Tons.		Per Cent.	
I.	Mines	18·0	..	10·8	42·5
	Factories	53·0	..	31·7	
II.	Iron and steel industries	28·0	..	17·4	
	Other metals	1·0			
III.	Brick-works, potteries, glass and chemical works, &c.	5·0	..	3·0	
IV.	Gas-works	15·0	..	9·0	
V.	Railways	13·0	..	7·8	9·0
	Coasting steamers	2·0	..	1·2	
VI.	Domestic purposes	32·0	..	19·1	
		167·0	..	100·0	

In connection with the work of the second Royal Commission on Coal Supplies, Mr. George Beilby prepared an estimate, from data got together by the Board of Trade, of the quantities of coal consumed in the United Kingdom for various purposes during the year 1903, when the total home consumption amounted to 167,000,000 tons. Of this total, factories and mines accounted for 71,000,000 tons (or, say, 43 per cent.); 28,000,000 tons (or, say, 17 per cent.) were consumed in iron and steel works; another 15,000,000 tons (or, say, 9 per cent.) were carbonized in gas-works for the manufacture of town gas; railways accounted for 13,000,000 tons (or, say, 8 per cent.); while 32,000,000 tons (or, say, 20 per cent.) were used for domestic purposes—leaving only 8,000,000 tons (or, say, 3 per cent.) for all other purposes, including glass and pottery works, chemical works, and the like.

Unfortunately, Mr. Beilby's estimate has not been kept up to date; and it is not possible to give any official figures relative to the 190,000,000 tons of coal consumed in the kingdom during the year 1913. From such unofficial estimates as are available, however, it would not appear that there has been any material alteration in the proportionate distribution of the total yield since Mr. Beilby's estimate was published. Assuming this to be so, it follows that if the coal used in mines, factories, iron and steel works, and for domestic purposes be lumped together, practically four-fifths of the total consumption will be accounted for. It is also in these directions that there are the greatest margins for economy.

Before, however, considering the probable magnitudes of these margins, I would venture, as a chemist, to suggest that what should be aimed at in all schemes of fuel economy is the abolition, wherever possible, of the present truly barbarous custom of burning raw coal, which not only entails the loss of valuable bye-products, but also involves the production of black smoke, with all its attendant evils. I am, of course, aware that in certain industrial operations—as, for instance, those in which reverberatory furnaces must be used—there may be at first some difficulty in finding a satisfactory alternative to the combustion of raw coal; but such difficulties can and must in course of time be overcome. In the vast majority of cases, however, no adequate excuse can be made for the continued use of raw coal.

Carbonization of Bituminous Coal.

This brings me to the subject of the carbonization of bituminous coal, by which term is meant the destructive distillation of coal in closed retorts or chambers, out of contact with air, whereby the volatile matter—tar, benzol, gas, and ammonia—is expelled and a residue of coke or "semi-coke" is left behind. In this way it is possible, with a properly-arranged auxiliary plant, to recover all the valuable bye-products and to utilize the gas for power or heating purposes; while the residual coke or "semi-coke" is, for many important purposes, superior as a fuel to the original coal, both on account of its higher calorific intensity and the smokelessness of its combustion.

The hard coke obtained by the carbonization of coal in suitable chambers at high temperatures is the fuel employed for the smelting of iron in blast-furnaces, and for melting iron in foundry cupola furnaces; and there is no reason why the somewhat softer coke produced in gas-works, or, even more so, the "semi-coke" obtained by carbonizing coal in iron retorts or chambers at comparatively low temperatures, should not in the near future entirely displace raw coal as a domestic fuel, except, of course, in the many cases where gas-heated fires or ovens are preferably installed. The particular point I wish now to bring home to you is that the continued use of more than 30,000,000 tons of raw coal, instead of coke, semi-coke, or gas, as domestic fuel means that we are deliberately sacrificing, for the sake of a big blaze in the fire-place, the whole of the ammonia, tar, benzol, naphtha, and other bye-products, the value of which would in the aggregate amount to many millions of pounds per annum, and at the same time we are unnecessarily adding to the atmospheric pollution of our great towns and cities by the smoke which goes up our chimneys.

The nature and proportionate yields of the bye-products obtainable by the distillation of coal will obviously depend principally upon two factors—namely: (1) The character of the raw coal; and (2) the temperature at which it is carbonized.

At the high temperature prevailing in coke-ovens and gas-works retorts are obtained: (1) Coke, which is essentially carbon *plus* the ash of the coal; (2) benzenoid and phenolic tars, together with ammonia liquor; and (3) from 10,000 to 12,000 cubic feet of gas per ton of coal, the calorific value of which may be anything between (say) 500 and 550 B.Th.U. per cubic foot.

Carbonization at Low Temperatures.

Low-temperature carbonization, on the other hand, is still only in the early stages of its technical development. But, helped by the war demands for high yields of light oils, it is now being energetically pushed forward; and provided that it is honestly worked at on sound lines, as a technical proposition, and with scientific supervision, but with no attempt at financial "booming," its future is, in my opinion, assured as an adjunct of the older systems of high-temperature carbonization, especially in view of the growing demands for light oils as motor fuels. There certainly will be room on the market for the products of all carbonizing systems, which, from the standpoint of public interest, should be encouraged and developed to their utmost limits.

Low-temperature distillation (say, at 400° to 500° C.) has the effect of decomposing the smoke-producing "resinous" constituent of the coal referred to in my last lecture, leaving a porous semi-coke, which is easily burnt in an open fire-place, and is smokeless in its combustion. The suitability of such a fuel for domestic purposes is obvious, provided always that it can be produced in a form which will stand transport by rail, and at a price which is substantially less than that of raw coal; for this is the *crux* of all low-temperature carbonization schemes. The tars obtained at low temperatures are richer in light oils than ordinary gas-works tar. Moreover, they contain paraffins, naphthenes, as well as benzenes and phenols; and from the point of view of motor fuel they are very interesting. The gas obtained is naturally much smaller in volume, but richer in its content of methane and paraffins, than that obtained at high temperatures. The question of low-temperature carbonization is so important at this juncture that the Government would do well to have its prospects investigated and reported upon by a body of independent and disinterested experts, as a precaution against possible set-backs due to foolish or premature company promotion, which so often in this country ruins the commercial prospects of a good thing. What is needed is a great deal of the kind of wisdom "that maketh rich but addeth no sorrow."

In the year 1913, about 40,000,000 tons of coal (or approximately one-fifth of the entire output) were carbonized in the United Kingdom—namely, about 20,000,000 tons in gas-works, primarily for the manufacture of town gas, and another 20,000,000 tons in coke-ovens, for the manufacture of hard metallurgical coke. Now in a modern gas-works the heating of the retorts is effected by the combustion, usually in two stages, and on regenerative principles, of a part of the coke produced; and the auxiliary plant is so designed that the whole of the valuable bye-products—including, if necessary, even the benzol and toluol—can be recovered, so that, under efficient management, the process becomes very economical so far as the utilization of all the products is concerned.

The gas industry is also to be credited with the achievement of two great improvements within recent years—namely: (1) The substitution of vertical for horizontal retorts, which, besides reducing labour charges, has resulted in appreciable economies in the coke consumption requisite to maintain a proper carbonizing heat; and (2) the introduction of the new nickel-catalytic process for the removal of carbon bisulphide from coal gas, which has now been brought to a successful issue by the combined skill and efforts of Mr. Charles Carpenter, D.Sc., Mr. Doig Gibb, and Mr. Evans, of the South Metropolitan Gas Company. They have shown that the sulphur (as CS_2) content of London gas can be reduced on a large scale, in regular day-to-day working, from nearly 40 grains to about 8 grains per 100 cubic feet, without in any way deteriorating the quality of the gas, at a cost (including interest and depreciation) of 0·299d. per 1000 cubic feet—thus providing a striking example of what may be achieved in industry by (to borrow Mr. Carpenter's own phrase) "the unrestricted and unreserved collaboration of the chemist and the engineer."

Bye-Products Recovery.

Turning, now, to the manufacture of metallurgical coke, though the bye-product recovery system has made great strides in this country during the past few years—as is evident from the fact that the amount of ammonium sulphate produced in coke-works increased from 17,435 tons in 1903 to 133,816 tons in 1913—it is nevertheless a deplorable fact that out of the 20,000,000 tons of coal carbonized in coking plants in the year 1913, no less than 6·5 million tons were treated in the old wasteful beehive ovens. Inasmuch as each ton of dry coal carbonized in bye-product ovens yields from 20 lbs. to 35 lbs. of ammonium sulphate, from 56 lbs. to 112 lbs. of tar, and from 2 to 3½ gallons of crude benzol, &c., according to the locality, as well as about 5000 cubic feet of surplus gas (the fuel value of which for industrial purposes may be reckoned at about 2·5d. per 1000 cubic feet), it would appear that the dead-loss in values to the country on account of the 6·5 million tons of coal carbonized in beehive ovens during the year 1913 amounted to nearly £2,250,000 sterling. In the face of such a fact as this, what do you imagine our rulers are doing? They are closing the British Museum and the National Portrait Gallery! I venture to repeat a suggestion which I made in my British Association address—namely, that public interest would justify the

Government fixing by law a reasonable time-limit beyond which no beehive coke-oven installation would be allowed to remain in operation, except by express sanction of the State, and then only on special circumstances being proved.

The question of the universal adoption of bye-product coking ovens, with benzol recovery systems, in the manufacture of metallurgical coke in this country is of such pressing importance at this crisis that I may perhaps venture to give a brief description of one of the most up-to-date plants which has recently been put into operation in the North of England, and upon whose design and installation very great chemical and engineering experience has been expended. It embodies what is known as the Otto direct recovery system; and by the courtesy of the erectors I am able to exhibit a series of photographs of the plant specially taken for this lecture.

Otto Direct Recovery Coke-Oven System.

The coke-oven is a rectangular chamber about 30 ft. long by 7 ft. high by 20 in. wide, with refractory fire-brick walls, and is built in batteries of from 40 to 60 ovens, with vertical side-flues between each oven, in which gas is burnt on a regenerative principle in order to maintain the high temperature required for satisfactory coking. The coal, crushed to a suitably small size, is charged into the hot oven through openings in the crown, from small hoppers which carry the coal from the storage bunkers on rails running along the whole length of the top of the batteries. The charge is then levelled, and all openings closed and sealed, so as to exclude air during the subsequent carbonization. At the conclusion of carbonization the doors at each end of the oven are opened, and the coke discharged by an electrically driven ram on to a sloping bench, where it is rapidly quenched with water.

The hot crude gas leaves the oven by an iron "ascension" pipe, which conveys it through a dip-pipe under a tar-seal into the hydraulic main—a long iron trough running the whole length of the battery of ovens, and through which hot tar is circulated. In the hydraulic main the heavier pitchy tars are deposited. The gas then traverses in succession a long horizontal pipe and an atmospheric cooler, of such length and capacity that the hot gas is cooled to its dew-point, which temperature naturally varies in accordance with the quantity of moisture the gas is carrying. The gas then passes on to the tar extracting apparatus, worked on the injector principle, where it is met by a large volume of hot tar and liquor, forced through the narrow neck of the injector (under high pressure) along with the crude hot gas. The hot tar and liquor are thus broken into a spray which dashes against the small tar particles in the crude gas, the effect of which is to collect and precipitate the whole of the tar in the gas. The gas thus extracted overflows into specially constructed tanks.

The tar-free gas, which still contains the ammonia, naphthalene, benzols, and all its moisture, passes next into a large enclosed vessel, called the "saturator," containing hot dilute sulphuric acid. In this vessel the gas is divided into a large number of small streams, which are drawn through the weak acid liquor by the suction of an exhauster. All the ammonia in the gas combines with the acid, forming ammonium sulphate, which is precipitated on the coned bottom of the saturator, where it is continuously ejected by means of compressed air into a receiver, where it is separated from any liquor (which is returned to the saturator), and thence is passed to a centrifugal dryer.

The gas from the saturator, still containing the benzols, naphthalene, and moisture, passes through a lead-lined catch-pot, which is so placed that it prevents any acid spray being carried over from the saturator, and then on to the bottom of the naphthalene extractor and spray cooling tower. This tower is quite devoid of any packing, but at the top of it there are several jets through which cold water is sprayed at high pressure. The action of this mass of finely-divided cold water beating suddenly down on to the hot gas produces a sudden chill, which, together with the concussion brought about by the water, precipitates and washes out nearly all the naphthalene, which then flows away along with the water into a catch-tank beneath the apparatus.

The gas, still containing the benzols, passes next through an exhauster, then through a second water-cooler, where the last traces of naphthalene are deposited and the gas itself is cooled down to practically atmospheric temperature. It passes thence to the benzol tower scrubbers, where it is washed with an oil which removes the benzol from the gas by a process of simple solution. These scrubbers, which vary in number according to the size of the plant, are from 50 to 70 feet high. The lower portion of each scrubber contains a reservoir for the circulating oil, while the upper portion is filled with a series of wooden grids. The oil is continuously circulated through these grids, and the gas, having to pass through innumerable thin layers of oil thus exposed to it, gives up the greater part of its benzol to the oil, and is practically debenzolized. On leaving the scrubbers, about one-half the debenzolized gas is returned to the ovens, where it is burnt to provide the coking heat; while the other half is a surplus, which may be used either for firing boilers, or for raising power in gas-engines, or as a public supply of town gas, to which it closely approximates in quality.

The crude benzol removed from the gas is subsequently rectified by special treatment in another portion of the plant, and finally leaves the system as benzol, toluol, xylol and solvent naphtha.

The Domestic Consumer.

If, in conclusion, I return to the domestic consumer, it is merely because he is not only the chiefest of sinners, but he is also the hardest to bring to the penitent form, and to establish in a state of grace. Even at the risk of being accused of labouring the point, I want to impress upon you the importance of looking to some form of carbonized coal, or the gas obtained in its manufacture, as the proper solution of the domestic problem.

The use of gas-fires is deservedly extending, because they are now very efficient, both in regard to their radiant power and from a hygienic point of view. The latest types have a radiant efficiency of 45 per cent. on the net calorific power of the gas consumed. They also burn silently, and ventilate a living-room nearly as well as a coal-fire; so that no one need now have any hesitation in installing a gas-fire from the point of view either of health or of its radiant power. A gas-fire is absolutely clean, requires no stoking, and can be lit up or turned off at a moment's notice, all of which advantages are absent in any form of fire burning solid fuel. On the other hand, with a good house coal, at as many shillings per ton as town gas is pence per 1000 cubic feet, it is possible to obtain for a given outlay almost five times as many heat units in the form of coal as in the form of gas—a fact which all advocates of gas-fires must reckon with. What we want in all great centres of population is cheaper gas, if we can get it; and yet there are many municipalities owning gas-works who artificially keep up the price of gas by the fatuous policy of taxing the gas consumer for the relief of rates.

Under present conditions, therefore, the use of gas-fires will in the main be limited either to flats or to rooms which are either only occasionally used, or are merely occupied for short periods during the day or evening—as for instance a dining room, or a professor's library. But where a room is in use every hour of the day, and every day during the week, I think we shall have to employ some form of smokeless solid fuel. If my friends in the gas industry are inclined to disagree with this conclusion, I would remind them that they are large manufacturers of coke as well as of gas; and so what they cannot have as meal they may appropriate as malt.

Professor Bone proceeded to describe the fire-place designed by Mr. Vernon Harcourt, and used by him for many years, which is specially adapted for the burning of coke. An illustration of the fire-place was given in the "Journal" for May 11 last (p. 332), in the course of the report of a lecture delivered by Mr. Vernon Harcourt before the Society of Arts.

COKE-OVEN MANAGERS' ASSOCIATION.

Proceedings at Saturday's Meeting.

A Meeting of the Coke-Oven Managers' Association was held last Saturday, at the Department of Applied Science of Sheffield University—the President (Mr. George Chrisp) occupying the chair.

Election of Members.

It was reported that the following gentlemen had been elected by the Council to membership of the Association: Mr. A. T. Thomson (Manvers Main Colliery) honorary member, Mr. E. A. F. Knott (Blaydon-on-Tyne), Mr. G. A. Todd (Pease and Partners), and Mr. W. C. Phillips (Manvers Main).

Amendment of Rules.

Notice of motion had been given by Mr. B. Wilson Haigh (Hon. Treasurer) of an amendment of the rules of the Association providing for a widening of the membership conditions in a manner which would render the honorary membership closely exclusive and reserved, and provide a place in the Association, as associates, for gentlemen connected with the industry but not qualified as coke-oven managers for ordinary membership. Mr. Haigh explained that he would be inclined to apologize for moving a change of rules so early in the history of the Association; but he had proposed a motion to the same effect at the meeting at which the rules had been constituted. It had not been found possible, however, owing to the circumstances of the moment, to give it due consideration; and events, it appeared to him, since the Association had got on its feet, had proved the need of some such provision. Mr. Haigh proceeded to illustrate in detail the classes of gentlemen who, by the proposed change, might be brought into the Association, greatly to its benefit.

Mr. Fred Hadfield seconded the proposition, on the ground that the strict reservation of the honorary membership list would greatly add to the status of the Association.

Mr. E. M. Myers, while heartily congratulating Mr. Haigh upon the care with which he had prepared and worked out his scheme, moved its rejection, on the ground that, above all else, the Association was primarily a Coke-Oven Managers' Association. They had already six honorary members, whose place in the Association would be rather uncertain if the new rule were adopted. There were other considerable objections to the scheme, in the possibility of a hesitancy of free discussion among younger members of the Association if some superior in the same concern or a coke-oven inspector happened to be in the room.

The Honorary Secretary (Mr. J. T. Price) seconded the amendment.

After a considerable discussion, in which several members joined, the proposition was defeated on a vote.

The Chairman then announced that the Staffordshire members

had a proposition which they desired to bring forward. The proposition of the Staffordshire district managers was at present taking up a good deal of the time and attention of the Council. It was that the Association, practically at once, take steps to form branches in different areas of the country, and that a representative of each area should be co-opted on to the Council. The Staffordshire managers felt that they were rather out in the cold. Personally, he thought it was a matter with which the Council were in tolerable agreement, and believed that it was in the best interests of the Association and of the craft that such branches should be established. Mr. Myers was there that evening to speak on behalf of the Staffordshire members; and he believed he was instructed to press the point that it was a matter of some urgency which should, if at all possible, be definitely dealt with that evening.

Mr. E. M. Myers said the coke-oven managers of Staffordshire, with the exception only of two, lived and worked in an area within four square miles; so that some time ago—before the Association was formed—they used to meet regularly at each other's houses or in a local hotel to talk over various matters relating to the technical working of their plants. They were very keen now that this should have recognition from the Association, and that they should have direct representation on the Council. He had acted as a kind of Secretary to the little group; and on behalf of his colleagues he moved the formation of sections or branches up and down the country, each to have one or more—he suggested no hard-and-fast line—representatives on the Council of the Association. Rule 25, of course, would have to be rescinded in order to make this possible—the rule being that the Council shall consist of the officers and five members of the Association, together with *ex-officio* members. He would very much like, on account of the fact that the Staffordshire members were such a long way from Sheffield, that this matter could be discussed and sanctioned or rejected that evening.

The President said it was against all rules of debate that this matter should be considered that night—no notice of motion having been given. The only way they could deal with it, if they wished to do so, was by the suspension of Standing Orders.

Mr. Myers said in that case he moved the suspension of the Standing Orders.

Mr. P. B. Nicholson seconded the motion.

Mr. Haigh moved a direct negative, on the grounds that, in view of the discussion they had already had that evening, they should be very careful as to altering rules, particularly in regard to rushing a matter through, as seemed to be desired in the present instance. He was fully in sympathy with the idea of the Staffordshire members; but he thought it should not be rushed. The Association should have presented to it some details of the proposed constitution of the branches, and suggestions as to the financial cost and responsibility. They should be given more time and more constructive details to think over.

Mr. J. A. Lee quite agreed with the point of view of Mr. Haigh that it would be much better to deal with this matter in the ordinary manner. There was, he suggested, nothing to prevent the members in different districts meeting together in an informal way and discussing matters and bringing their results to the Association; but he could see no special reason why they should rush the present proposal through. For this reason he seconded the amendment.

Mr. Myers, replying, said the coke-ovens of this country were not all in the Sheffield district. He would like to know how many members from over twenty or thirty miles from Sheffield were regular attendants at the meetings in Sheffield. He was convinced that by the formation of branches the Association would develop more rapidly.

Mr. Haigh said they were all agreed on that; it was only a question of whether they should vote that night.

Mr. James Marshall said he could not see the occasion for the hurry. He thought they should have time to consider the proposition, and vote at the next meeting.

Mr. Myers said the distance from Staffordshire was very great, and the journey meant a strain on the time and pockets of those members if they wished to travel to Sheffield even once a month. He could not think it was likely that the members of the Association would change their minds on the need of the branches between that evening and the next meeting.

Mr. Marshall said the idea of the Staffordshire men having a representative on the Council had the full approval of the Council; but they did not wish the thing to be rushed.

Mr. Myers remarked that there were other areas besides Staffordshire which could be very advantageously formed into district branches.

The motion for the suspension of Standing Orders was defeated. Mr. Myers then gave notice of motion of his proposition.

The President said he would suggest that Mr. Myers or one of his colleagues should be present at the next meeting and bring up a scheme of working.

Three Methods of Sulphate of Ammonia Manufacture.

Mr. T. H. Riley, a member of the Council, then read a paper on "The Advantages and Disadvantages of the Three Methods of Sulphate of Ammonia Manufacture at Bye-Product Coke-Ovens." This, together with notes on the discussion to which it gave rise, follows the above report.

METHODS OF SULPHATE OF AMMONIA MANUFACTURE AT BYE-PRODUCT COKE-OVENS.

THEIR ADVANTAGES AND DISADVANTAGES.

By T. H. Riley, of Tinsley Park, Sheffield.

[A Paper read before the Coke-Oven Managers' Association, on Saturday, Jan. 29.]

The crude gases evolved during the carbonization of coal in retort-ovens contain ammonia and various other bye-products. The system in general use for the recovery of ammonia at coke-works until the year 1907 was the indirect process—*i.e.*, a series of tower scrubbers were used for stripping the gases of ammonia, using water as the absorbing agent. About this time the Koppers' semi-direct process was introduced into this country, and was first put into operation at the coke-plant belonging to the Flimby and Broughton Moor Coal and Fire-Brick Company, Limited, at Maryport. Patents, however, were taken out by Koppers in 1904 for both the semi-direct and the direct processes.

The three systems under consideration are:

Indirect Process.—The ammonia is recovered in the form of ammoniacal liquor, which is treated in a still.

Semi-Direct Process.—In this case the gases are cooled, and the resulting liquor, which contains the "fixed" ammonia, is treated in a still. The vapours mix with the preheated gases containing the greater part of the "free" ammonia before entering the saturator.

Direct Process.—There are no water condensers in this system for cooling the hot gases before the saturator.

The Indirect Process.

The water vapours (which contain about half the ammonia) are removed, along with the heavy tar, by condensation of the hot gases drawn from the hydraulic main, the condensates being collected in a tank (or tanks) and separated. The cool gases, at a temperature of about 25° C., are then forced through a tar extractor to remove the tar, preparatory to their entering the ammonia scrubbers or washers. The weak liquor and added water used for absorbing the ammonia in the gases are circulated through the scrubbers, after which the liquor, which contains about 1·20 per cent. of ammonia, according to the arrangement of the plant, is sent forward to the ammonia still, to be treated for sulphate of ammonia in the usual way.

The amount of liquor made at a forty-oven plant, carbonizing 270 tons of coal per day, containing 10 per cent. of added water, has been found to be 40·5 tons. This liquor is condensed between the ovens, the primary coolers, and the tar extractors. The additional fresh water required in the scrubbing plant is 50 tons, which means that a total of 90 tons of liquor has to be dealt with in twenty-four hours. The strength of the liquor is 1 per cent. of ammonia.

In many plants of this description an acid bubbler has also been used for taking out the final traces of ammonia by means of 60° Twaddel sulphuric acid—the resulting mother liquor being sent to the sulphate plant. Owing to the trouble which arose through dirty salt blocking up the dip-pipes of the bubbler (no doubt the semi-direct method originated this), bubblers were discarded, and a so-called improvement—an earthenware washer consisting of a series of trays—was tried; fresh water being admitted into the top tray and sulphuric acid in the tray immediately below. The washing was quite effective; but another trouble arose. It was found that the earthenware could not withstand the vibrations caused by the exhauster forcing the gases through the seals. The trays consequently were continually breaking; and this particular type of washer had a very short life.

With regard to the indirect method generally, the advantages are none, while the disadvantages are many:

1. A large number of pumps, storage tanks, &c., are required.
2. The plant occupies a large area, and demands a great deal of supervision.
3. The whole of the ammonia has to be recovered by distilling the ammoniacal liquor; and, consequently, a large quantity of effluent has necessarily to be dealt with, and a great amount of steam is required.
4. Inefficient scrubbing and loss of "free" ammonia, through the scrubber grids becoming blocked with naphthalene and sediment from the water used for washing the gas (if hard water is used), and, at times, should the sprinklers become blocked, from the unequal distribution of the water.

Koppers' Semi-Direct Process.

In this process the gases on leaving the ovens are cooled down to about 25° C.; the condensate being heavy tar containing the naphthalene and ammoniacal liquor. The exhauster then forces the gases through a tar-extractor, after which they are reheated with exhaust steam to a temperature of 60° C. At this point the vapours from the ammonia-still (the liquor condensed in this system is treated for its ammonia), having a temperature of 95° C., are mixed with the reheated gases, entering the saturator at 65° to 68° C., and combining with sulphuric acid to form sulphate of ammonia. After the gases leave the saturator, at a temperature

of 60° C., they are again cooled to about 25° C. before entering the benzol scrubbers.

From actual observation the amount of liquor made at a forty-oven plant, carbonizing 270 tons of slack per day, containing 10 per cent. of added water, was 35 to 40 tons, of a strength of 1·1 per cent. ammonia. This was the quantity which required to be treated in the ammonia-still, during twenty-four hours.

The advantages of this process are many:

1. No naphthalene troubles.
2. Less risk of loss of ammonia.
3. Effluent considerably reduced.
4. Sulphate of better and purer quality.
5. Less steam required, as there is less liquor to be treated, and exhaust steam is used.
6. The plant is much simpler to work and is more efficient.

The Direct Process.

In this method the gases on leaving the ovens pass through air-coolers, being cooled from 150° to 85° C. The condensate consists chiefly of tar and ammoniacal liquor; the ammonia being in a "fixed" state. When the gases have left the coolers, they are drawn through special apparatus, coming in contact with hot tar-sprays under a high pressure, or centrifugal machines, to remove the final traces of tar and condensed vapours, and then through turbo-exhausters. [These have been found to be most suitable for dealing with hot gases.] After this, the gases enter the saturator at 70° to 75° C. under a pressure of about 12 inches water-gauge, and are deprived of their ammonia by means of sulphuric acid—leaving the saturator at 65° to 70° C. In the saturator well a dry steam-coil is used to prevent the formation of mother liquor from the moisture carried over with the gases.

After the gases have been stripped of their ammonia, they are condensed to remove the water vapours in suspension, and the naphthalene, before entering the benzol scrubbers. If the coolers are not of ample size, the water vapours will be carried along with the gases into the first benzol scrubber, thereby reducing the efficiency of the scrubbing oil.

With regard to the quantity of liquor containing "fixed" ammonia from the condensation of the gases between the ovens and the tar sprays or centrifugal machines, this, of course, is a variable quantity, according to the quality of the slack used. It is usually circulated round the plant, and when sufficiently concentrated it is either sold or treated separately, as blockages would otherwise occur in the gas-mains and other parts of the plant. This liquor is also a nuisance, due to some of the ammonium chloride separating out and attacking the wrought-iron mains and machinery. There is also another condensate peculiar to this system—viz., a mixture of water and naphthalene—which is condensed from the gases after the saturator. The naphthalene on cooling is made into a marketable product. The water, however, gives rise to similar trouble to that experienced in dealing with the effluent from an ammonia still.

The chief feature of this process is that probably more "free" ammonia passes direct with the gas to the saturator. The disadvantages of the system are:

1. More power is required than in the semi-direct process, owing to the high speeds of the centrifugal machines and turbo-exhausters. [If the liquor made were treated in a still, then even more steam would be required.]
2. Indirect loss of the "fixed" ammonia, owing to the salts crystallizing out in the gas-mains, and passing away with the tar.
3. Effluent from the final coolers.
4. Tar much thicker than in the other two proces ses.
5. Trouble is effectually removing the tar, owing to the gases being much hotter.
6. More wear and tear on a portion of the plant, due to the presence of ammonium chloride.

DISCUSSION.

The President said Mr. Riley's subject was one which lent itself to considerable discussion. The author, he knew, would welcome it. His criticism of the indirect process came rather as a surprise to him (the President). He himself had had no experience in the direct method, and he would be very glad to hear views on the subject. In the meantime, he had received by letter a few comments from Mr. G. Stanley Cooper, who was unfortunately unable to be present.

Mr. Cooper in his letter said Mr. Riley did not favour them with his views as to which of the three systems he really preferred, though it was fairly apparent from the advantages which he had given for the semi-direct process that his working experience of this was exceedingly favourable. He (Mr. Cooper) had a fair experience of direct and semi-direct recovery; and he gave his opinion unhesitatingly in favour of the semi-direct process as worked out by Koppers. To his mind it embodied all the other systems combined. Perhaps the only important point that it was at a disadvantage was the fact that some effluent liquor was produced. The principal claim which was made on behalf of the hot direct-recovery process was that there was no production of ammoniacal liquor, and hence no distillation was required. He had visited a number of plants, both here and in Germany, and he had never yet found that this claim could be substantiated. It was rather interesting to follow it out to its logical conclusion. In the first instance, particularly when compressed coal was used—which meant that the total production of ammoniacal liquor was not less than 12 per cent. of the weight of coal—it was very difficult to maintain such a temperature round the plant that the whole of this liquor was kept in a state of vapour. The difficulties involved in attaining this were so great that the users of the hot direct processes fell back on the device of allowing just a little condensation. Now they knew perfectly well that if they allowed any condensation whatever, the condensate would contain a proportion of both free and fixed ammonia. Without condensation the fixed ammonia passed forward with the gas into the saturator, where two reactions were possible. Either ammonium chloride—which was the principal constituent of the fixed ammonia—was decomposed with liberation or hydrochloric acid gas, or it remained as ammonium chloride in the sulphate; and the ammonia value being higher in chloride than in sulphate, equivalent value was not obtained. In the first instance, the presence of hydrochloric acid in the mains soon became evident by the amount of corrosion which went on, and the heavy wear and tear of the apparatus generally. If, then, proper recovery of the fixed ammonia was to be made, there must be condensation. At the plant with which he was associated, for instance, one-third of the ammonia yield was fixed ammonia, and he was sure could not have been efficiently dealt with under the hot direct-recovery process. They got then the fact that condensation was necessary to eliminate the fixed ammonia. Such condensation also necessarily involved a solution of a proportion of free ammonia in the liquor; and to recover this free ammonia distillation in some form or other was necessary—a process not allowed for in the hot direct system. Without condensation and cooling of the gases to a temperature of less than 40° C., a considerable quantity of water vapour remained in the gas, with the result that this was frequently deposited in the saturator, thereby diluting the liquor. They knew that the action between sulphuric acid and ammonia was exothermic, and it was able to supply to some little extent the heat required to evaporate the water which would otherwise be deposited in the saturator. It was, however, not sufficiently exothermic to maintain the strength of the bath with the hot direct-recovery system without either some condensation or external heating of the mother liquor. The latter was frequently resorted to; but it was attended with very grave difficulties. He questioned whether there was a plant in the country, working under the conditions which Mr. Riley worked under, which was getting the same sulphate yield as he was obtaining. By this, he meant sulphate yield actually, and not sulphate equivalent. He knew of plants where the hot recovery process gave good yields of ammonia; but, unfortunately, a proportion of it was in the form of that liquor which they were not supposed to make, and which was sold in bulk, because they had no facilities for recovering the ammonia it contained without resorting to the distillation which they as loudly disclaimed as being necessary. The author was right in pointing out that the effect on the tar was also very noticeable with the hot direct-recovery process; but it could hardly be called tar so much as pitch. With ordinary precautions pitch troubles were comparatively rare with the semi-direct process, as also were naphthalene troubles; but he was given to understand that they were exceedingly common with hot recovery. He would, however, like to congratulate Mr. Riley upon the excellent way in which he had put before the members the principal points for consideration in comparing the three systems of ammonia recovery. He agreed fully and entirely with the points he had put forward in respect of each, and would certainly advocate the semi-direct process of the Koppers type as being the simplest, and at the same time the most efficient, for ammonia recovery.

Mr. Haigh said he could not claim for the semi-direct process that there was a 10 per cent. yield of ammonia, as there was in the indirect process. Perhaps Mr. Riley could tell them if there was any increased yield at all, and what was the difference between the two processes. He was rather sorry the paper was short of figures; but they knew that figures were difficult to obtain. He would have liked to hear something of comparative initial and working costs of the three systems. He believed the first cost of a semi-direct plant was higher than that of the indirect plant.

Mr. Riley said, in regard to the yield of sulphate of ammonia in connection with an indirect plant, at the plant at which he had been engaged they had taken an average for the first twelve months of its working, and found that the lowest yield was 25 lbs. and the highest 27 lbs. Since starting the semi-direct plant the productions had considerably increased, though using a similar size of coal. They found their average was about 31 lbs., and their best figure had been 33 lbs. With regard to a point raised by Mr. Haigh as to steam, he really could not give any definite figures; but on their semi-direct process they had two Lancashire boilers, which it had been thought were hardly sufficient, and provision had been made for a third if necessary. They now found, however, that one boiler, heated by surplus gas, was quite sufficient. With regard to the cost, he was afraid if they went into this question they would sit there all night. If he had thought they desired information on cost, of course he would have endeavoured to provide some figures; but he did not know whether they would have agreed with them or not.

Mr. G. W. J. Bradley said Mr. Riley appeared to be very down on the indirect process. It seemed to be, first of all, from the quality of the salt. He (Mr. Bradley) thought that, if properly worked—as all coke-oven plants should be—the indirect plant would leave very little to be required in regard to the salt quality.

In connection with the semi-direct process, he knew very little. The author raised objection to the hot direct process on account of the effluent from the naphthalene cooler. The plant with which he was associated was using the naphthalene water for quenching the coke; so that it was all got rid of, and there was no objectionable effluent whatever. The sulphate of the direct process would not bear comparison with that of the other two methods. It contained the whole of the basis of the gas, and he believed it caused in some places considerable heating-up of the salt, due to oxidization. He would be interested to know how the consumption power bore comparison with the cost of reheating of the gas.

Mr. RILEY said, in regard to the losses of ammonia and the shortage of acid in connection with the semi-direct process, of course, they had storage of ammonia. If their coolers were only powerful enough——

Mr. BRADLEY: But we are concerned with actualities.

Mr. RILEY (continuing) replied that that depended largely on the plant. One trouble arose in one plant which they did not get in another. With regard to the direct process, if they were short of acid they lost fully 75 per cent. of their ammonia. As to the reheating of the gases, this was done by the exhaust steam, in his own case, from the exhaust boiler. With regard to the still for working the liquor, it was practically all exhaust steam there also. There was very little live steam.

Mr. MYERS said he had read a paper on the same subject some eighteen months ago. What he had found at that time, and asserted again now, was that the whole thing depended on what kind of coal was being distilled; and, therefore, on this question they must determine what kind of process they were going to put in. An important point which most people seemed to fight shy of was the fact that nearly the whole of the fixed ammonia was ammonium chloride. Was it not a retrograde step to separate this salt from ammonium sulphate? This was the very great disadvantage both of the semi-direct and the direct process. Mr. Riley was not quite correct, he thought, in saying that on the direct-recovery plants this ammonia was either distilled separately on the plant or else sold. If the liquor could be changed into marketable ammonia, then the process was not taking any retrograde step; and he was very sorry to say that, although direct-recovery plants had been working for about three years on a large scale in this country, very little had been done on this important subject. At his own place they were selling their ammonia as a marketable product for galvanizing. In any product which had to deal with coal that contained much ammonium chloride—15 to 20 lbs. per ton of coal—if these plants were going to separate up the salt they were not acting on true scientific principles. What was wanted now was a sound commercial process for making commercial and saleable ammonium chloride on a coke-oven plant.

Mr. RILEY said, with regard to ammonium chloride, there was no doubt that in the semi-direct process they had to separate it up again. When the hot process was introduced into the country, however, it was said there was no condensation whatever; but then the trouble arose of the gas attacking the pipes. The pipes were afterwards lead-lined, but still there was trouble. It was then that the best thing to do was to cool the gases slightly, and so get rid of the trouble. There was no doubt that in many plants they had treated the ammonium chloride separately. On ammonia plants it was a nuisance to them, and they got rid of it in the tar or sold it to other people. They circulated round and round; and he knew of one case where it used to run away down the stream. It attacked the pumps, the wrought-iron mains and pipes, and was a nuisance. The sooner they could get rid of it or make it into a saleable substance the better.

Mr. MYERS said he held no brief for builders of any process. But there was very little condensation on the direct-recovery plant. In his case, they got their liquor containing, at 15° C., about 15 per cent. of ammonia. The free ammonia in the liquor would be something like 0·02 per cent. They found that all free ammonia was useful, when the liquor was to be evaporated, to keep the liquor neutral and prevent any attack on the vessels in use.

Mr. RILEY said at one plant working in the district for eighteen months past they made from their gases 20 lbs. of sulphate per ton of coal. The other 11 lbs. of the 31 lbs. total was the equivalent of sulphate of ammonia from the liquor sold.

Mr. SPENCER asked why in the indirect process Mr. Riley only got 27 lbs. per ton, and in the semi-direct he got 30 lbs. per ton of the same coal.

Mr. RILEY replied that there were many points in the indirect process which they had to watch as regarded wastage; whereas in the semi-direct there were very few. If their scrubbers were not large enough, the grids became blocked with naphthalene, or the sprinklers might not be distributing properly. In the semi-direct process there was direct control by the men and very easy supervision, and this was probably why there was this gain.

Mr. SPENCER said they had something like 33 lbs. per ton of coal, and they lost about 0·5 per cent. per ton of coal, which Mr. Riley admitted was very good.

Mr. MYERS said the only loss on his own concern's direct plant was due to the effluent liquor. He had examined several ammoniacal liquors, or, as it was called, obnoxious effluents. They kept it down to between 0·05 and 0·02 per cent.; and there were about 40 tons.

Mr. W. GREEN said he found in the direct plant that he had no difficulty in disposing of the effluent liquor from the coolers—that was, if the plant was worked properly. Also, in connection with naphthalene troubles, they had a system of removing the naphthalene from the gas as it went through the scrubbers, which worked quite satisfactorily. In regard to the effluent liquor, the ammonia contained in this liquor never reached 0·02 per cent., except in one or two special instances. It was generally between 0·01 and 0·015. He thought the plant was working very efficiently as regarded the ammonia loss, which was infinitesimal. In connection with the indirect process, Mr. Riley put the ammonia and the ammonia bye-liquor about one to one. He (Mr. Green) had heard this stated generally; but he had heard that it was not always true on the Koppers plant. He understood it said that the liquor was sometimes more than half. In connection with the indirect process, as regarded the blocking of the scrubbers, in his own case the gas was treated very well for the removal of the ammonia in an experience he had had with rotary scrubbers. The scrubbers never showed much trouble in this respect.

Mr. MYERS asked if Mr. Riley would give them the approximate percentage of fixed ammonia.

Mr. RILEY: I should think two-thirds fixed.

Mr. GREEN asked if it was fair to treat the systems for comparison on twenty-four hours' working. Would it not be better to take the average working for a week or a couple of weeks, as the coal varied considerably in quality? The quality of the coal on the two days selected for the comparisons of Mr. Riley might have been considerably varied.

Mr. RILEY said, so far as he knew, there was practically no variation in the quality of the coal in use on the occasions of his comparisons.

Mr. GREEN said, in connection with the direct process, his concern had obtained 33 lbs. and 34 lbs. per ton; but this might be dependent on the quality of the coal treated. There was no doubt, however, that they had obtained a very satisfactory yield and a minimum loss in the process.

Mr. LEE said it was natural that those who had had particular experience of one system should think their system was the best. He, personally, had had much experience of the indirect process and little with the others. It seemed to him each of the three processes had its own distinct advantages for its own especial plants. Mr. Riley was hardly justified in saying there were no advantages for the indirect process. It was much more elastic than the other two systems. Those of them who were now having difficulty in producing their supplies of sulphuric acid, might be interested to know that in this respect the indirect process was proving the most elastic of the three methods. Every plant had a limit to its storage capacity; but they could get on with the concentration of their liquor in the indirect process in a manner which they could not possibly do in the other two processes. He thought the point raised by Mr. Myers was very important. It was wrong in practice that they should have some material which was already prepared for them to put on the market, and lay themselves out to decompose this material. It should be their business to go along on the lines at which they were aiming, with the minimum amount of expense in other material, to put on the market those things which were produced for them in their processes. In the long run that process would succeed which would produce the marketable sulphate of ammonia. He thought the semi-direct process would ultimately be that which would lend itself to being the best system to put in. It was certainly incorrect, therefore, to say there were no advantages in the indirect process. The fact was they all required very careful watching and management. He quite appreciated Mr. Riley's point that one could have more hours away from the plant which he chiefly recommended; but he had never known a manager to be called out to deal with difficulties of the indirect process, either in gas-works or in coke-oven plants. In every one of the processes the same call was made for efficient management and supervision, both in the managing and the chemical department. When these were done, every one of them would yield exactly the same ammonia from the same plant if conditions generally were equal. He was sorry Mr. Riley had not given capital and working costs of the three processes; for it was capital cost which would have to be considered when suggesting improvements or new plants. If he could have given to the paper the figures, it would have added materially to its value.

Mr. RILEY said there was no doubt that if each of the systems was constructed in a right manner, and was conducted properly, and general conditions were equal, they could recover the same amount of sulphate from one as from another. With regard to the capital costs, if he had gone into these details it would have taken hours and days and weeks. As to working costs, between the semi-direct and the indirect there was very little, if any, difference. In the semi-direct they had had their troubles on their own plant. One wanted to work it one way and one another way; and even the men wanted to have their own way in the matter. At times, instead of making sulphate of ammonia, they were making rock salt. Since those times, however, they had overcome these troubles. There was another question. With the semi-direct process, owing to the fact that they cooled the gases to a normal temperature, the gases were practically free from moisture. On top of the ammonia still at his plant they had a condenser to further reduce any possible vapour; and the result was they had very little condensation, whereas Mr. Myers mentioned that his concern had had about 30 to 40 tons per day.

Mr. MYERS said this figure was effected in their own case very largely by the amount of moisture in the coal.

Mr. HAIGH said that Mr. Riley had somewhat modified his

original statement, and said that they could get the same ammonia from the indirect as from direct methods, providing all things were equal.

Mr. RILEY said that was so, if all things were equal. There was no doubt there was a loss of free ammonia in the indirect process. Probably most of it took place in the deposit tank, and also where they had open hydraulic mains.

Mr. LEE remarked that there could, of course, be very great loss through evaporation; but he took it they should all understand that it was their business to keep the tank covered, and that all their fittings should be covered. If not, they had better understand this at once. If they kept all their points covered there was very little loss of ammonia. The output at his place had been as high as 1·7 per cent., and their average was 1·65 per cent., though he admitted they had a good quality of coal.

Mr. BRADLEY said, in connection with the thickening of the tar, he had seen some of the thickest produced in the indirect process and some of the thinnest in the direct process. Surely it was a question of conditions, as suggested in regard to fixed ammonia, and there was nothing in it to condemn a system on.

Mr. GREEN said if they had the actual loss in each case they would get to the rock-bottom of each process, and would know which was the most satisfactory.

Mr. MARSHALL asked Mr. Riley if he could give some figures of comparative losses in the three systems. He presumed Mr. Riley would take his gas make both on the old process he had used and on the one he was now using. In the indirect processes he got, according to the paper, 25 to 27 lbs. per ton, and he (Mr. Marshall) took it that in getting the 31 and 33 lbs. in the semi-direct process, he was calculating on the same coal. What was the increase due to? Had he lost a lot of ammonia and sent it back and decomposed it?

Mr. RILEY replied that in the indirect processes the loss in the return gas, worked out in pounds per ton of coal, was 0·02 lb., and the loss in connection with the semi-direct method was 0·003 lb. This was the best result they had had, but they had had very much worse. He might say that the losses in the semi-direct process, if they watched the saturator bath, were very little indeed; but if the cracker-pipe became partially blocked up, there was unequal distribution of gases and consequent loss.

Mr. G. TAYLOR remarked that he thought the amount of sulphate should be expressed in terms of the amount of nitrogen in the coal, and he considered that if stated in such terms the amount of sulphate in all three processes would be quite clear.

A MEMBER asked as to the effect of using these processes on the yield of benzol. If they took the semi-direct process, it was cooled down, heated up again, and had to be cooled down again, and he would like to know if it took much cooling to get it down to 15° once more. There was the question of the direct process. If they had to use a lot of water by external cooling, it might perhaps be better to cool by interior cooling by running the water down through the gas, as was done in the indirect process. He would like to know if Mr. Riley could give any information on this question, and as to whether he thought it was easily possible to get the gas down cool enough without extra cooling when using the semi-direct and the direct processes.

Mr. RILEY said with regard to the semi-direct, at his place they had one cooler. The water came in direct contact with the gases; and they got the temperature down to about 22° C. It was very seldom—with the exception of occasionally very hot summer weather—that it got above 25°, and this could be avoided by running-off the water and getting a fresh supply. As to the hot process, of course, they had very much more water vapour to cool down; and it was due to insufficient cooling area that trouble arose in this respect in ammonia plants.

The CHAIRMAN, bringing the discussion to an end, said information in regard to the effect on benzol had been hitherto somewhat lacking. He was an indirect man himself; and his experience of the other two methods made him believe that, under proper conditions, the indirect could be made to produce as much sulphate as the others. It was certainly a very elastic system, and the amount of storage they could have was double or treble that of the other systems.

On the motion of Mr. T. FOSTER, seconded by Mr. J. SYLVESTER, a hearty vote of thanks was accorded Mr. Riley for his paper.

MODERN ILLUMINATION.

By E. STROUD.

[A Paper read before the London and Southern District Junior Gas Association, Jan. 28.]

This paper is the last of a series which the author has given this season before the different Junior Gas Associations. It was early found to be impossible to deal comprehensively with the whole matter set out in the synopsis. Therefore it was thought advisable to deal with the subject more or less in sections. The last paper, given before the Scottish Junior Gas Association on Dec. 11, dealt primarily with photometric or distribution curves of various sources. This present one will be principally on illumination calculations, and the method of deriving them from the photometric curve.

The distribution or photometric curve is the graphic representation of the light distribution. The intensity of light is taken for various angles in a vertical plane to the lamp axis, and plotted in terms of candle power, conveying a clear idea of the manner in which the light is emitted. In view of the differences of distribution it is possible to obtain with bare sources and with various reflectors, it is of paramount importance for the lighting engineer to know exactly what distribution he will obtain from any particular unit. To this end, with all commercial lighting units there should be published their corresponding distribution curves.

THE ILLUMINATION CURVE.

Having available the distribution curve of a light unit, an illumination curve can be derived, giving for any definite mounting height the foot-candle intensities of illumination at various distances out from a point directly under the light unit. This curve is derived by means of formulæ based on what are known as the inverse square law and the cosine law.

INVERSE SQUARE LAW.

The illumination intensity on any surface varies inversely as the square of the distance between the surface and light source; and the fundamental law of illumination mathematically expressed is:

$$I = \frac{C.P.}{D^2}$$

in which I equals the intensity of illumination in foot candles, C.P. equals the candle power in a given direction, and D equals the distance in feet from the source to the surface. This holds true, however, only for surfaces at right angles to the ray of light, and does not apply where the light falls obliquely on the surface under consideration.

In practical illumination, most of the rays do not meet the surface normally. When this is so, the horizontal illumination may be obtained by calculating the normal as above; and these results multiplied by the cosine of the angle between the ray of light and a perpendicular line drawn from the light unit to the illuminated surface.

$$I_h = \frac{C.P.}{D^2} \text{ Cos A}$$

In this formula, however, both D and A are variable for points at different distances out from the point directly under the light unit.

By the simple trigonometrical method known as Lambert's Law, this formula can be converted into one involving instead of D the perpendicular height H of the light unit above the plane. The formula then becomes:

$$I_h = \frac{C.P.}{H^2} \text{ Cos}^3 \text{ A}$$

Having at hand a table of cubed cosines for the different angles, and since in any given problem H^2 is constant, we have to determine only the candle power at the various angles in order to solve the illumination at any point.

Fig. 1 shows an example of the actual derivation of an illumination curve from a photometric curve. The photometric curve is first plotted in the upper left-hand corner of the figure.

Horizontal Illumination $1_h = \frac{C.P. \cdot \cos^3 a}{H^2}$

D	a	$\text{Cos}^3 a$	C.P.	I_h
0	0	1·00	108	3·00
1	9·5	0·96	109	2·90
2	18·5	0·85	117	2·77
3	27·0	0·71	128	2·51
4	34·0	0·57	145	2·30
5	40·0	0·45	160	2·00
6	45·0	0·35	169	1·66
7	50·0	0·27	174	1·28
8	53·5	0·21	168	0·98
9	56·0	0·17	155	0·72
10	60·0	0·13	135	0·49
12	64·0	0·08	90	0·21

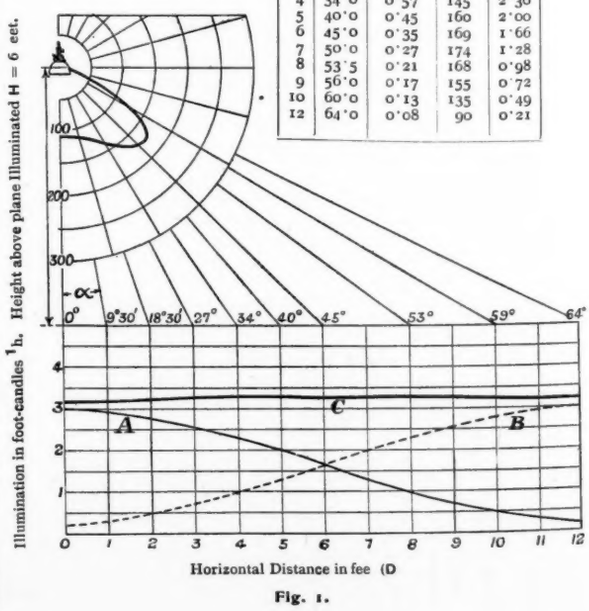
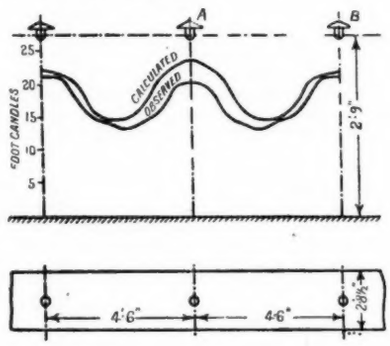


Fig. 1.

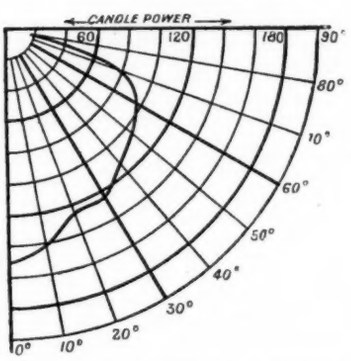
The height above the plane of illumination is assumed to be 6 feet in this case. Then the ray of light at 45° out from the downward direction will strike the plane of illumination 6 feet out from the point directly under the unit. This gives the basis of the horizontal distance scale for the illumination curve; and the distance scale may be laid off, using distances apart of 1 foot for the small angles, and distances of 2 feet for the higher angles. It is only necessary then to carry back the radial lines for the 1 foot and 2 feet intervals until they intercept the photometric curve, and read the candle power at the points of interception.

These are entered in the table in the upper right-hand corner of the figure, as shown, multiplied by the proper value of the cosine cubed, and the product divided by the square of the height—in this case 36. The result is the horizontal illumination for the given point. This process is repeated for the other points. Then a scale of foot candle intensities is assumed for the diagram and the derived values of I_h are plotted as vertical distances, giving us the resulting illumination curve for the unit in question at the given height of 6 feet above the plane to be illuminated.

With the illumination diagram at hand, it is possible to find the illumination at various points in any space under consideration with a given position of the light units; the illumination at each point being the sum of the illumination at that point from each separate unit. All of these latter are determined, of course, by the distance of the point from each light-source. By the "point-by-point" method, as it is called, the illumination, neglecting reflection from the surroundings, can be determined with considerable accuracy. This accuracy has been proved many times by the author, and was also shown conclusively in a paper given by Professor Clinton before the Illuminating Engineering Society in March, 1914. One particular installation proved by Professor Clinton is shown. This was the local lighting of a work bench by incandescent gas-burners. Fig. 2 shows the spacing and plan of bench, together with calculated and observed curves of illumination, and also the polar curve of the unit. The difference between the mean of the calculated and observed values is less than 5 per cent. Reflection from surroundings would have very little effect in this or any case of local lighting.



Illumination of Workshop Bench.



Polar Curve of Lamp and Fitting used in Lighting Bench.

Fig. 2.

These illumination curves are often very necessary and useful. But in practice shorter methods are employed. Tables are available giving for various heights and distances out the angle of the light ray and the foot-candle intensity of illumination produced by 1-candle power. To apply this to any photometric curve, it is simply necessary to read the candle power from the curve at the angle given, for the height and distance out selected, and multiply this candle power by the illumination which 1-candle power produces at this point. With these tables, it is possible to obtain quickly the horizontal illumination which any light-source of known distribution gives at any point.

Spacing of Units.

The spacing of units is sometimes fixed by architectural considerations; but as far as possible it is advisable to arrange the lighting units in the form of squares or rectangles, placing a unit in the centre of each. It is assumed that it is required to obtain even illumination over the working area. Therefore upon the distance between the units and the height at which the units can be placed will depend what form of distribution curve one will require. The use of the illumination graph for this purpose is most clear.

The more focussing the reflectors are, the closer together they must be, relative to the height, to get even illumination. Though, of course, the closer the units the higher degree of illumination one would get. Illumination problems generally call for one of three types of distribution—known as "extensive," "intensive," or "focussing"—and reflectors are designed to this end.

With the units placed at the same height, the illumination is increased from the extensive to focussing, though the area covered is decreased. Conversely, one could place the focussing reflector much higher, and obtain the same illumination over the larger area. Therefore, in deciding the type of reflector to employ, one must use a certain amount of judgment. Generally, the higher the units are placed the better, so as to avoid the lights coming into the direct line of vision to obviate glare.

Rating of Lamps.

The recognition of the measurement of "illumination," which is the effect of lighting, is gradually becoming an accomplished fact. But to be able to fulfil a specification of a certain foot-candle intensity of illumination, one must know, as well as the distribution of the unit, the actual candle-power values. There should be a recognized standard rating of lamps—a rating that should be accurate. It is perfectly clear that, should one have a fictitious candle-power value, the resultant illumination will not be accurate.

There is another greatly discussed point in connection with the rating of lamps. Makers usually rate their lamps according to the maximum candle power, in whichever direction it may be. It is well known that it is possible to get, by means of reflectors, a tremendous increase of candle power over a small zone in a vertical direction relative to the lamp; but it is certainly wrong to rate the lamp according to this maximum. Lamps should be rated rather by the quantity of light which they emit—*i.e.*, lumens (M.S.C.P. × 4π), or mean spherical candle power.

Measurement of Illumination.

The testing of the illumination values of actual lighting installations is an extremely easy matter; there being several very portable instruments on the market for this purpose. One of these is the "Holophane" Lumeter. [This the author proceeded briefly to describe.]

[The reading of the paper was accompanied by a large selection of slides—diagrams referred to by the author, actual installations of good interior and exterior lighting, and examples of wrongly and rightly placed lights. When Mr. Stroud resumed his seat, he was asked a number of questions by members on points that had been raised; and these he afterwards replied to at length.]

DISCUSSION.

The President (Mr. S. B. Chandler, of the South Suburban Gas Company) remarked that Mr. Stroud's name had recently appeared a good deal in the Technical Press in connection with lectures he had given, dealing with illumination problems, before the different Junior Associations. Their own was not the least instructive of the series.

Mr. D. J. Winslow (Lea Bridge) said it would be interesting to know whether Mr. Stroud had verified by actual tests on the Lumeter the calculations of the horizontal illumination by the cube of the cosine of the angle for the distances named, so that they could be sure the table worked out correctly. One was a little doubtful at times about relying too much on the results worked out by various angles, and so on.

Mr. F. Pearce (North Middlesex Gas Company), referring to the Lumeter, asked whether, in reading the number of foot-candles on (say) a table, it was necessary that the instrument should be held at any particular distance from the surface. It seemed to him there must be a difference in the reading, if the instrument was first held 2 feet away, and then moved to 10 feet. If distance did not matter, it seemed to him a very simple method of estimating the amount of light.

Mr. F. C. Briggs (Gas Light and Coke Company) said that he thought most of them quite envied Mr. Stroud the interesting work he was in a position to do in connection with this subject. It seemed to him that one of the most interesting problems with which the gas engineer had to deal was the scientific treatment of illumination. To make a fairly accurate forecast of the illumination one was going to get under certain conditions, it was necessary to be dealing with a scientific unit. He heartily agreed with the author in emphasizing the necessity for polar curves. He wondered why the manufacturers of lamps generally did not give them. Firms who did do so, were helping gas engineers very much indeed. He would like to know something about the actual amount of light absorbed by the type of fitting which had a prismatic bowl below the light.

Mr. W. L. Westbrook (North Middlesex Gas Company) agreed that the higher the unit of light was placed the better, so as to avoid the trouble of direct glare in the eyes. If, however, Mr. Stroud was going to provide a certain amount of illumination, so many foot-candles, on the working surface, he might have to con-

sume an extra amount of gas or current if he used a different type of reflector and placed the unit higher.

Mr. PEARCE, alluding to the question of polar curves, pointed out that, if two different mantles were taken, although they were made by the same manufacturer, they did not necessarily give the same illuminating power. Again, the quality of the gas might vary from day to day. A lamp might be tested one day with a certain gas; and then on the next occasion when it was tested, perhaps the gas would not have quite the same calorific value. He did not know whether any allowance was made for variations of this kind. It seemed to him an important point, because results might differ widely.

Mr. D. C. CROSS (Lea Bridge) inquired whether, when using the Lumeter, one would get the same result if reading the illumination the same distance away from a light (say) on a blackboard and a white sheet.

The PRESIDENT said the paper had shown them what enormous strides had been made during the last few years in the scientific application of illumination. Mr. Stroud had given them some interesting data, and no doubt assisted to clear up many little points which had arisen in their minds from time to time. To him (the President) the term "candle power" had always appeared to be rather vague. It was difficult sometimes to know what makers meant when they talked of a certain burner or lamp emitting so much candle power. It was therefore desirable some general agreement should be come to on the subject of the rating of lamps by the quantity of light they emitted—lumens or mean spherical candle power. But, better still, he agreed with Mr. Briggs when he said that a polar curve should accompany the description of a lamp. A long time ago, he (the President) put forward this suggestion in a paper which he read. Unless the statements of makers were backed up in some such way, it was impossible to know where one was. Of course, it must not be forgotten that the absorptive or reflective power of surrounding objects made a difference to the resultant illuminating power of the burner put in. There were, he thought, four very good rules which should always be adopted by those seeking to produce satisfactory illumination; and he might be allowed to quote them. In the first place, the working surface should always have the highest illumination. This was generally very well understood. Secondly, illumination should always be as uniform as practicable. In the third place, shadows should be avoided. Fourthly, glare should be obviated by means of efficient shades or else similar translucent appliances. They were much obliged to Mr. Stroud for his paper.

Mr. STROUD, in the course of his reply to the points raised in the discussion, said it did not matter at all what was the distance, when using the Lumeter, from which one peered at the standard card. The only thing which could interfere with the reading would be atmospheric conditions—such as fogginess of the air. The reading would, of course, be different on a black and on a standard card. The instrument was calibrated to a standard white card, which should not absorb any light to give accurate readings. They must have the polar curve. A unit should not be used unless its performance was known. When a person bought an article, he wanted to know what it would do; and with regard to the candle power of lamps, it was extremely important that there should be an accurate recognized standard of rating. A lamp at present could be rated at anything one liked. There was no law under which a man could be had up for calling a lamp 10,000 candle power if it was 10 candles. Unless they could get actual rating of lamps, it was impossible to secure definite illumination. He had been asked a question as to the absorption of light by the use of the bowl type of reflector. With the particular prismatic bowls in the lighting installation he had shown, the absorption was about 15 per cent. To speak of absorption by itself was, however, most misleading. If one was getting 50 per cent. of light where it was not wanted, it was being wasted anyhow. If a light was covered by a reflector or shade, a certain obscuration resulted; but there was certain work being done by the shade. If the shade was raised 2 feet above the source of light, there was no absorption; but the shade was not doing any work. Whatever reflector was used, its performance—that was, its polar distribution—must be known. For different heights from the working surface, different types of reflectors would be used to secure the required result. The four lighting rules given by the President were very good ones.

The proceedings concluded with a hearty vote of thanks—proposed by Mr. BRIGGS, and seconded by Mr. KEMP—to the author and to his Assistant, Mr. Tye.

THE CONTINUOUS MANUFACTURE OF AQUA AMMONIA.

The number of "Gas Record" [Chicago] for the 22nd ult. contained an interesting account by Mr. P. Plantinga, of Cleveland, Ohio, of the Gas Machinery Company's system of making aqua ammonia on a large scale from crude ammoniacal liquor—the plant operating with a minimum of purifying agents.

The author points out that aqua ammonia is made by absorbing ammonia gas, free from impurities, in distilled water. Commercial aqua ammonia has a specific gravity of ·898 or 26·4° Bé, and 100 lbs. of it contains 29·4 lbs. of ammonia (NH_3) and 70·6 lbs. of water.

If aqua ammonia is to be made on a large scale, the process must not only be continuous, but the apparatus must necessarily operate with a minimum of purifying agents and expense. The apparatus described requires (exclusive of the lime used for recovering the fixed ammonia contained in the crude liquor) only an exceptionally small quantity of caustic soda, oil, charcoal, and lamp black for the elimination of such impurities as cannot be automatically driven off by the apparatus itself.

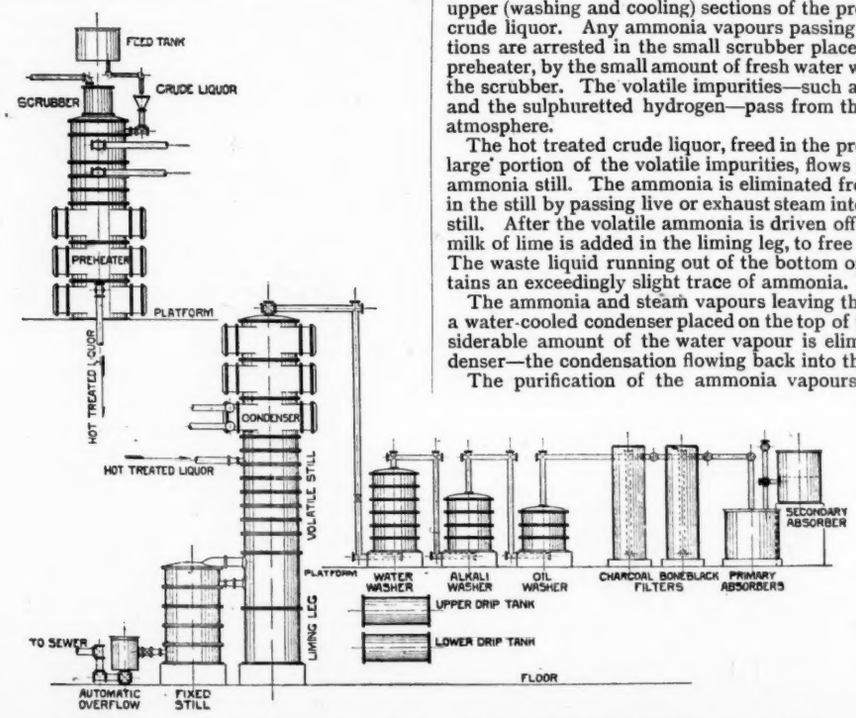
The illustration shows the general design of the apparatus, wherein the automatic elimination of the impurities from the liquor is based on the fact that carbonic acid and sulphuretted hydrogen are easily driven off in large quantities when crude liquor is heated to (or nearly to) its boiling point.

The machine operates as follows: The cold crude gas-works or coke-oven liquor is pumped into an overhead feed tank, from which it flows at a uniform rate into the top of the preheater. While passing down through the preheater it is heated by live or exhaust steam, which drives off the larger portion of the volatile impurities—such as carbonic acid and sulphuretted hydrogen. Some ammonia also is driven off; but this ammonia is caught in the upper (washing and cooling) sections of the preheater by the cold crude liquor. Any ammonia vapours passing through these sections are arrested in the small scrubber placed on the top of the preheater, by the small amount of fresh water which flows through the scrubber. The volatile impurities—such as the carbonic acid and the sulphuretted hydrogen—pass from the scrubber into the atmosphere.

The hot treated crude liquor, freed in the preheater from a very large portion of the volatile impurities, flows into the top of the ammonia still. The ammonia is eliminated from the crude liquor in the still by passing live or exhaust steam into the bottom of the still. After the volatile ammonia is driven off in the volatile still, milk of lime is added in the liming leg, to free the fixed ammonia. The waste liquid running out of the bottom of the still only contains an exceedingly slight trace of ammonia.

The ammonia and steam vapours leaving the volatile still enter a water-cooled condenser placed on the top of the still; and a considerable amount of the water vapour is eliminated in this condenser—the condensation flowing back into the top of the still.

The purification of the ammonia vapours is mainly accom-



CONTINUOUS AQUA AMMONIA APPARATUS FOR HANDLING AMMONIACAL LIQUOR.

plished in the water-washer. A small stream of fresh water is run continuously into the top of this washer, and forms aqua ammonia on its way down. The ammonia in the water-washer combines with the remaining carbonic acid and sulphuretted hydrogen contained in the ammonia vapours; and in this way these impurities are entirely eliminated. As considerable heat is evolved by the absorption of ammonia in the water, the water-washer sections contain water-cooled coils.

The overflow from the water-washer runs into the upper drip-tank, from which it is drained periodically into the lower drip-tank. From the latter tank it is usually run back to the crude-liquor tank or well, or the drippage is forced by compressed air into the preheater, where the larger portion of volatile impurities is again driven off.

The caustic or alkali washer is used for a safety or catch washer; a small amount of caustic soda solution being added periodically to arrest such impurities as may pass the water-washer accidentally. But an exceedingly small amount of caustic soda is required.

The oil washer is used for eliminating organic compounds; and fresh oil is seldom added.

Two filters, one filled with charcoal and one with bone-black, are used in series to remove the colouring matter from the ammonia gas. The charcoal and bone-black are seldom renewed. If the plant is to be operated continuously, two pairs of filters are installed with the required bye-pass connections to allow of one pair being kept in reserve.

There are two primary absorbers for the purified ammonia gas. While one is absorbing ammonia to make aqua ammonia, the other is emptied, and then filled with distilled water. To prevent any waste of ammonia, a two-compartment secondary absorber is provided; and the weak aqua ammonia formed in this absorber is drained periodically into the empty primary absorber. The absorbers are provided with cooling coils, as a great deal of heat is generated by the absorption of ammonia in water.

The aqua ammonia from the primary absorbers is usually temporarily stored in an aqua-ammonia storage tank; and, after being filtered, it is loaded into tank cars, drums, or carboys. The finished product is a water-white aqua ammonia, which not only fulfils the standard specification, but impurities are practically absent. It is, however, not chemically pure, as the aqua ammonia comes in contact with steel in the filters, absorbers, piping, and storage tank.

Excess Profits and Mineral Rights Duties.

A good deal of uncertainty exists as to the precise scope and intention of that part of the Finance (No. 2) Act, 1915, which imposes a new war tax in the shape of an excess profits duty. To remove this uncertainty, Mr. R. M. Montgomery, K.C., and Mr. William Allen, both of the Inner Temple, have written a book in which the chief provisions of the Act are clearly and concisely explained, and instructions are given as to how to find whether the profits of any business are liable to the duty, and, if so, the amount of the duty involved. This is followed by the sections of the Act, with notes pointing out certain difficulties which appear to arise in its construction, and the relevant cases. Under one section of the Act, there is imposed another duty, which is known as the excess mineral rights duty; and this is fully dealt with. The section [43] is a long one; and for its proper understanding, it is necessary to be acquainted with certain sections of the Finance Act, 1910, which are also quoted. There are no doubt many people to whom the book will prove useful; and they will find its value added to by the inclusion of a very complete index. "Excess Profits Duty and Excess Mineral Rights Duty" is published by Messrs. Butterworth and Co. and Messrs. Shaw and Sons, and the price is 7s. 6d. net, postage extra.

Testing a Surface-Combustion Furnace.

The Director of the United States Bureau of Standards has communicated to the Franklin Institute some notes from the recently issued annual report of his department, which, as usual, contains material of great technical interest to industries generally and to scientific laboratories. On the subject named above the Director remarks: In view of the fact that the surface combustion process appeared to offer many advantages for high-temperature laboratory furnaces, in which the Bureau is interested, it was decided to submit a crucible furnace of this type to a thorough test. For the purpose, the furnace was equipped with meters on the gas and air lines, and with a chimney to permit the collection of flue-gas samples. In several runs the mixture proportions were maintained constant, while varying the rate of gas consumption. Temperatures were read by a Holburn-Kurlbaum optical pyrometer. The highest temperature reached was 1675°, at which point the muffle failed. The test established that complete combustion could be attained without excess air; that the best air-gas ratio was 5·5; and that a 20 per cent. excess of air caused a lowering of the furnace temperature of 100°. An account of this test, which is the first of its kind, is in course of preparation.

Society of Engineers.—At a meeting of the Society to be held in Caxton Hall, S.W., at 5.30 next Monday, Mr. Percy Griffith will deliver his Presidential Address. The premiums awarded for papers read before the Society last year will be presented by Mr. Norman Scorgie, who was President for 1915.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

French Mask for German Pipes.

SIR,—I beg to inform you that your reference to my works, "*La Société Métallurgique d'Aubrives et Villerupt*," as being controlled by Herr Thyssen, or any other German, is absolutely false. I have been closely associated with my Board of Directors for the past eighteen years, and regret to see you should have been so foolishly misled.

I am conferring with my works head offices in Paris, as to the best means of remedying the damage we may sustain by your publication.

54, *Holborn Viaduct, E.C., Jan.* 26, 1916. A. G. CLOAKE.

[The letter of "Anti Germanicus," which appeared last week, and which furnished us with the authority for some editorial remarks, was, we understand, based upon the book to which the writer of the letter referred—"L'Allemagne en France," by Louis Bruneau [Librairie Plon, Rue Garancière, Paris]. This book made prior publication of the statements to which exception is taken by Mr. Cloake; and it has been in circulation in this country through at least one well-known library. But, so far as we are aware, there has not been any attempt to cause the author of the book (which is in its fifth edition) to withdraw his assertions, or to suppress their circulation in France. We shall be glad to learn from the Company if anything has been done in this direction, because surely the source of any misstatement of which complaint could be made should have been before this dealt with in Paris, where, and not in this country, are situated, as our correspondent says, the "head offices" of La Société Métallurgique d'Aubrives et Villerupt. As to the "JOURNAL" having been "foolishly misled," the letter of "Anti Germanicus" was published in the "Engineer" on Jan. 21—that is, before it appeared in our columns—and in the "Engineering Supplement" to "The Times." From this it appears that, if we have erred, it is in respectable company; but the blame must rest largely upon the negligence in Paris in not having prevented the continued dissemination of the information in the book written by Louis Bruneau. Our readers will note Mr. Cloake's denial as to the French Company having any German association in the matter of its direction.—ED. J.G.L.]

Casting Pipes.

SIR,—With reference to the letter in your issue of Jan. 25, signed "Anti-Germanicus," we are surprised that any "M.Inst.C.E." should be so lacking in knowledge of the methods of British foundries.

We beg to say that this firm has been for many years making cast-iron socket-pipes, cast vertically, with sockets downwards, and a head-on spigot, and afterwards cut off in the lathe to ensure solidity, and has no means of casting them otherwise.

As to lengths of pipes, we have for some years been making pipes of 6 inches to 12 inches diameter (inclusive) in 4-metre lengths, and all other sizes (except 3-inch diameter) in 12 feet lengths.

The above disposes of your correspondent's reasons Nos. 2 and 3.

With regard to his reason No. 1, the cost must, of course, be considered not only as to price, but also as to relative qualities.

For JAMES OAKES AND CO.,

Queen Victoria Street, E.C., Jan. 26, 1916. F. WILLIAMS.

Gas Chemists.

SIR,—Now that gas chemistry is coming into its own, having almost attained the dignity of a separate profession, may I suggest that the time is ripe for the formation of a "Society of Gas Chemists"?

In these strenuous times, such a Society should prove of great benefit.

At present, gas chemists are scattered through the different societies like lost sheep; and besides the great advantage of discussing "shop" with "fellow sufferers"—union is strength.

Jan. 29, 1916. AGAS CHEMIC.

Plymouth Corporation and the Watershed.—It is proposed by the Plymouth Corporation to purchase the fee-simple of the land constituting the watershed. The land is situated on Dartmoor and its border, and comprises 4891 acres. The owner, with whom a provisional agreement has been made, is Sir Henry Lopes. The whole of his rights are to be acquired in consideration of a perpetual chief rent of £825 per annum, which the Corporation may redeem at any time, on giving six months' notice, for the sum of £22,000. The Corporation will acquire properties yielding a rental on agricultural holdings of £631 with some apportioned rents for sporting rights and other minor properties. Sir Henry Lopes is allowed £125 per annum for a term of seven years for these apportioned rents; and the Corporation are to be allowed an easement for aqueducts or pipe-lines without payment for the land taken or damage through construction. The provisional agreement is subject to confirmation by the Council. Apparently it has arisen out of negotiations with reference to the laying of the new pipe-line which the Corporation are about to construct to increase the flow of water to the enlarged bore.

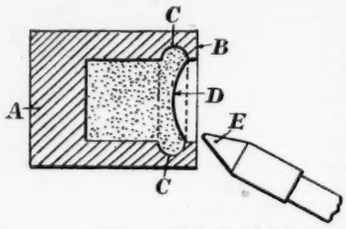
REGISTER OF PATENTS.

Incandescent Light Production from Rare Earths.

JAUBERT, G. F., of Paris.

No. 23,443; Dec. 2, 1914.

This invention relates to a compound of rare earths for producing incandescent light by means of blow-pipes using mixed gases—such as oxy-acetylene, oxy-petrol, oxy-ether, and the like.



Jaubert's Incandescent Light.

The device shown consists of a hollow receptacle A of carborundum, alundum, or other refractory earth resisting very high temperatures. Formed in proximity to the edge B, with a circular groove C, the interior is filled with a compound of rare earths, the constituting elements of which are oxide of thorium, oxide of cerium, magnesia, and lime in different quantities according to the kind of light it is desired to obtain. The compound is provided with a small quantity of an alkaline polysilicate (such as powdered glass) intended to fulfil the function of a flux, and especially to produce, when in contact with the flame of the blow-pipe, the very rapid hardening of its external surface.

The following percentage proportions have been found good: Oxide of thorium, 92; oxide of cerium, 2; magnesia, 2; lime, 1; flux (ground glass), 3. The mixture is placed in pulverulent form in the container A with its surface formed concave as a D.

The advantages and features of the compound are said to reside in the incorporation of the flux in the mass, the effect of which is that, as soon as the compound is exposed to the flame of a blow-pipe E, it permits the rapid hardening of the external surface D, which is succeeded by the illumination. Also, in order to regenerate the surface D after prolonged use, a small quantity of the powder composition is spread over it and exposed to the flame of the blow-pipe.

In this way a "simplified and highly efficient compound of rare earths for the production of incandescent light" is claimed to be obtained, and "a simple and efficient device for using the compound."

Liquid Meters.

HAMILL, W. W., of Glasgow.

No. 245; Jan. 7, 1915.

This invention relates to meters of the type in which a vane or the like is arranged in a channel through which the fluid is directed; the vane blocking the channel to a more or less extent and being displaced along the channel by the force due to the flow of the fluid. It relates to the variety in which the axis of the channel and the path of the vane lie in an arc of a circle, and in which the fluid is deflected by the vane out of the channel into a discharge chamber.

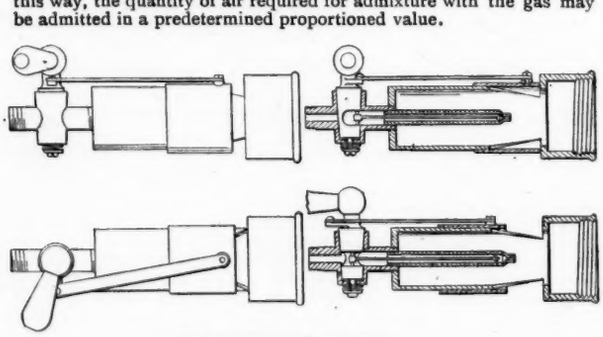
The invention consists in a construction of a meter in which the vane is arranged obliquely across the channel in a manner to deflect the liquid towards a slit connecting the channel with the discharge chamber, and the provision of a main chamber inside (or mainly inside) the channel—the vane being supported on an arm which passes through a slit connecting the main chamber with the channel. The slit is covered and closed by a drum, disc, or annulus pivotally supported within the main chamber and carrying it within the indicating means.

Gas and Air Mixing Device.

HALE, S. H., of Kansas City, U.S.A.

No. 1944; Feb. 6, 1915.

In this device for mixing gas and air the gas is controlled by a needle-valve capable of adjustment with regard to its seating and associated with the plug of the tap in such manner that the turning on and off of the tap produces a longitudinal movement of the needle. In this way, the quantity of air required for admixture with the gas may be admitted in a predetermined proportioned value.



Hale's Gas and Air Mixer.

The device comprises (in combination) a plug cock for controlling the main volume of gas, a needle valve for controlling its emission across an air space, and a sliding sleeve for regulating the extent of opening for the air to such air-space—the whole connected together in such a manner that the rotation of the plug cock produces a longitudinal movement of the needle valve and sliding sleeve.

An illustration is given of a side elevation and plan of the device; also longitudinal sectional views showing the cock valve and sleeve in their closed and open positions.

From these it will be seen that there is provided a gas-mixer wherein the gas and air will be effectively mixed and the amount of air mixed with the gas be increased or decreased as the quantity of gas is increased or decreased. The device is so constructed that there are two valves—one in the pipe and one in the nozzle—which will both be seated at the same time to prevent any escape of gas. The stopcock or valve in the supply pipe will open slightly in advance of the opening of the valve in the nozzle, so that the full pressure of gas will be behind the valve in the nozzle, before it is unseated, and thus upon its unseating the gas will be ejected from the nozzle under full pressure.

Gas-Fires.

VALENTINE, H. S., of Glasgow.

No. 3095; Feb. 26, 1915.

This is an improvement upon the methods of fitting gas-fires like those described in patent No. 1524 of 1913.

As then proposed, a back plate or frame was provided for the reception of the gas fire, adjustably secured in place in the coal-fire grate and to the exterior of the legs by lugs, and (or) to the bottom grating of the grate by an angle plate—removable and adjustable panels being provided which partially overlapped the legs and served to conceal the lugs or other devices securing the back plate or frame in place.

The present "more simple and more easily fitted arrangement" consists in providing the back plate with arms so arranged that when the "inset" fire is in place they bear against the interior surface or back of the existing grate instead of the exterior. It further consists in making the arms capable of adjustment to various sizes of grates, and also in providing adjusting means in conjunction with the arms whereby the gas-fire may be drawn into the fire place of the grate and caused to make a close fit with the "legs."

Ignition Apparatus of Gas-Engines.

CLIMIE, WILLIAM, JUN., of Port-Glenone, near Belfast, and LEES, W., of Glasgow.

No. 10,354; July 16, 1915.

This invention has reference to fittings adapted to suit various forms of sparking plugs; and it consists in constructing the insulators of the insulated electrode of ignition apparatus so that the installation will not short-circuit with damp; while the plug can be either used as a low-tension or as a high-tension sparking plug by simply changing the return or uninsulated electrode from one form to another.

Gas-Heated Hand Irons.

FLETCHER, RUSSELL, AND CO., LIMITED, and BANKS, W., of Warrington.

No. 10,405; July 17, 1915.

In this arrangement the flexible gas-supply pipe is connected to the iron by an attachment adapted to swivel within suitable limits about a horizontal axis. It comprises a horizontally disposed nipple or nozzle provided with a lateral branch to which the flexible supply pipe is attached, and a bush, sleeve, or the like in which the nipple or nozzle is mounted so as to be capable of limited free angular adjustment or movement about its axis.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Jan. 26.]

Nos. 691—1063.

ADAMS, A. H. B.—"Reducing the lighting effect of lamps." No. 1057.
ASKAM, J. F.—"Gas-burners." No. 836.
CARPENTER, H. A.—"Charging mechanism for gas-generating apparatus." No. 856.
CHANDLER, D.—"Gas-kilns." No. 874.
COOK, D.—"Gas ovens or furnaces." No. 737.
CUTLER, S.—"Charging gas-retorts." No. 1047.
FENWICK, J. B.—"Hydraulic mains." No. 911.
GALLIMORE, J.—See Cook. No. 737.
HALL, A.—"Connecting branch pipes to main pipes." No. 1056.
M'LACHLAN, R. W.—"Shade holders." No. 801.
RICHARD, V. H.—"Apparatus for cooking and heating by gas." No. 1006.
RITER-CONLEY MANUFACTURING COMPANY.—See Carpenter. No. 856.
Riter-Conley Manufacturing Company.—"Charging and discharging retorts." No. 857.
SOUTH METROPOLITAN GAS COMPANY.—See Chandler. No. 874.
THOMSON, LIMITED, D.—See Cook. No. 737.
USSHER, L.—See Hall. No. 1056.
WARNER, A. W.—See Carpenter. No. 856.
WHITE, A. E.—See *Riter-Conley Manufacturing Company*. No. 857.
YATES, H. JAMES—See Askam. No. 836.

Westminster Public Lighting Contract.—The Westminster City Council have been informed by their Special Committee on Reduction in Expenditure that the estimated charge for street gas lighting would, as the result of the new contract recently approved by the Council, be reduced from £13,000 to, approximately, £10,745—a saving of £2255 for a whole year, and of £840 for the current year. No saving had been foreshadowed in respect of the estimate of £23,500 for electric street lighting.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Sulphate of Ammonia.

Sir WALTER ESSEX on Monday last week, asked the President of the Board of Trade whether he was taking steps to ensure that the surplus of sulphate of ammonia over and above all home agricultural and munitions works' requirements may be equitably distributed among the buyers of neutral nations who had already made contracts for large supplies.

Mr. ACLAND (the Parliamentary Secretary to the Board of Agriculture) replied that it seemed quite possible that during the next few months there might not be any such surplus as that suggested. He hoped, however, to be in a position to make a statement as to the position of the Government with regard to the export of sulphate of ammonia before the end of the session.

Sir W. ESSEX asked the Minister of Munitions whether he was aware that the action of the Board of Agriculture, in totally prohibiting the export of sulphate of ammonia was likely seriously to diminish the output of T.N.T. and other materials necessary to the manufacture of munitions; and, if so, would he say what steps he proposed to take?

Mr. LLOYD GEORGE remarked that he was communicating with the Board of Agriculture on this question, with a view to reconciling the various public interests which were affected.

Last Thursday Mr. E. WASON asked the Parliamentary Secretary to the Board of Agriculture what steps, if any, had been taken to restrict or prohibit the export from this country of sulphate of ammonia, with the view of making certain the retention of a sufficient supply to meet the needs of British agriculture.

Mr. ACLAND said that the Board of Trade and the Board of Agriculture had, after consultation with the Ministry of Munitions, decided that for the present no licences for the export of sulphate of ammonia should be issued. It would not be possible to continue the withholding of licences indefinitely, as the normal production in this country considerably exceeded the consumption, and he ventured to express the hope that farmers would take this opportunity of securing ample supplies at the earliest possible date. Such a course would combine prudence with patriotism, and he confidently relied upon all agriculturists to adopt it.

Colonel YATE: Can measures be taken to reduce the price of sulphate of ammonia, which has gone up from £14 to £17 a ton?

Mr. ACLAND: The cost of production has also gone up very much, and I think a limitation of exports ought to be the surest way of securing that sulphate of ammonia shall be offered at a fair price to the farmer. The Government cannot hold out any hope of bringing down the price to anything like the pre-war level, or even to the level in the early part of the war, because the cost of manufacture has gone up very much.

Sir W. ESSEX: Has the fact been considered that the limitation made by this Order in the disposal of sulphate of ammonia will compel the producers practically to give a bonus to the farmers?

Mr. ACLAND: If it compels them to make reasonable offers to farmers, I shall be very glad, because that will be very much in the interest of the nation in encouraging and facilitating the production of food, which is a very important national object.

LEGAL INTELLIGENCE.

Conspiracy and Protection of Property Act.

At Hanley, before the Stipendiary Magistrate (Mr. Bertram C. Brough), Daniel Heath, a stoker employed at the Fenton Gas-Works, was summoned under the Conspiracy and Protection of Property Act, 1875, with breaking a contract which he had entered into with the County Borough Council. The facts which were disclosed during the hearing were that Heath was a good workman when he left alone the drink. On Dec. 24, he went to work the worse for drink, and failed to properly carry out his duties. Two days later, he sent a message to the gas-works saying that he would not be able to work that night. He was reported as being under the influence of drink while at work on Dec. 27; and on the following day he absented himself altogether, without giving notice. It was pointed out that if the other workmen had acted in the same way at Christmas, when the calls on the station were larger than at ordinary times, the supply of gas to the town would have been endangered. On two occasions when Heath had failed them, the foreman had worked all night; and the three other workers of the gang had been good enough to do his work as well as their own. The Stipendiary ordered defendant to pay a fine of £3, and £1 1s. costs.

Claim by a Gas Manager.

In the Reading County Court, last Thursday, before his Honour Judge Harington, Mr. S. W. West claimed to recover £10 10s. from the Twyford (Berks.) Gas Company, of which he had acted as Secretary and Manager. Plaintiff (who conducted his own case) maintained that when he left the employ of the Company, the Directors undertook to give him a "small honorarium," so long as they thought fit and he acted in a loyal and friendly spirit; and it was for this he sued. Cross-examined by Mr. Warren (for the Company) plaintiff said he continued in the service of the Company until March 25, 1914, and was paid in respect of that work, and also a half-year's salary (£35) from March to September of the same year, in consideration of his giving up the Secretaryship, and of assistance he had given to the Company. On July 1 the Directors wrote that they had not agreed to give him any honorarium; and he then replied that as he had been approached to interest himself in other means of lighting, he felt quite at liberty to consider his own welfare in the matter, as they had not offered him any hope for the future. In another letter he said he had no desire to be disloyal to the Company in any way, but could not study the Company's interests to his personal disadvantage. On Oct. 22 last, his successor wrote that the Directors were of opinion that he had rendered the Company no service, nor taken any steps in their interest to entitle him to consideration. He threatened County Court proceedings, and got a reply that it would be well for him to consider carefully whether the taking of such proceedings might render necessary a close examination of the Company's business for some years past. The plaintiff then had put to him a number of searching questions as to financial transactions. His Honour said the suggestions were very serious; and he asked plaintiff if he could explain how it was, in one case named, that he had collected £7 3s. 9d., and only paid in £5 17s. 3d. Plaintiff replied that he was very sorry he could not explain it. The whole thing was a mystery to him; and probably books which would have explained matters had by this time been destroyed. Judgment was entered for the Company, with costs.

A Disputed Wet Meter Registration.

At the Lincoln City Police Court, last Tuesday, John Roberts was summoned for failing to pay a gas bill for £3 11s. 5d. He admitted not having paid the bill, because he disputed the quantity of gas alleged to have been used. Mr. Bagshaw, for the prosecution, said the meter had registered accurately; and tests made in accordance with the Sale of Gas Act had proved that it was reliable. It was, however, a wet meter, and defendant had a desire for a dry one. The Corporation had about 14,000 consumers; and it was impracticable for them to let each customer have the particular kind of meter he might desire. If defendant wanted a dry meter, he was quite at liberty to provide one himself. Three offers had been made to defendant to have the meter tested, upon the usual terms; but he had not accepted them. As he would not pay for the gas consumed, the supply was cut off, and the meter taken away. The variation allowed by the Act was 2 per cent. in favour of the seller, and 3 per cent. in favour of the consumer. The meter had been found to be 1·5 per cent. against the defendant. It did not, however, follow that he was charged for more than was supplied. The meter was over a copper, and the water evaporated, which would be in favour of defendant, as also the fact that the house was on the hill, and would have increased pressure in the pipes. The probability was that he had had more gas than he was charged for. As to the question of a leakage, if there was one in the inlet-pipe the gas which escaped was not registered. Defendant said he had offered to pay half the amount claimed, and have a new meter; but the Gas Department had not accepted this. The Corporation claimed for nearly 13,000 cubic feet of gas, whereas he had not used 5000 cubic feet. The Magistrates found that the meter supplied by the Corporation registered correctly, as was proved by the official tests. With reference to any leakage, it was defendant's duty to attend to this; and the onus did not rest with the sellers of the gas. There would be an order made for payment of the amount claimed.

Lancaster's Good Character.

When moving the confirmation of the minutes of the Gas Committee at the monthly meeting of the Lancaster Town Council, Alderman Sir N. W. Helme remarked that it would be satisfactory to the Council to know that in the difficult conditions of finance in the country, they had secured the assent of the Local Government Board to proceed with the raising of the necessary money for the supply of gas to the new works and houses for workers. He had personal intimation from the Board that it was because of the sound system of finance that the Corporation had for many years applied to the gas undertaking that it was felt the unusual course could be allowed of anticipating parliamentary powers. The Provisional Order would no doubt receive sanction; but for the moment the Corporation had the assent of the Board to proceed. The policy of the Committee had been to strengthen the financial condition of the concern; and in the future they must endeavour to build-up the reserve fund by avoiding the application of the whole of the profits to keeping down the rates. The reason for the establishment of water-gas plant was that the supply of gas might be immediately increased. Ordinary plant could not have been erected until well on in the summer; and this would have deferred the supply of the increased amount to the new works. It was proposed to produce by means of the new plant half-a-million cubic feet of gas per day, or one-third of the production. It was hoped by this means to avoid any shortage of gas in summer. Alderman Bowness said they should congratulate themselves upon having earned such a good character.

Municipal Profits and the Birmingham Rates.—The Birmingham trading committees have been considering what amount to offer the Finance Committee in relief of the rates; and, though a certain secrecy has been maintained, it is believed that the total amount will be about £100,000. The local "Post" credits the Gas Committee with a proposal to give £25,000, the amount of their original offer last year. On that occasion they were pushed up to £37,350; "and it may be that this time they will eventually increase their final offer to a somewhat similar sum."

Pudsey Gas Company.—The report for the year ended Dec. 31, to be submitted at the annual meeting of the Company to-day, states that, though the restricting of public lighting materially affected the sales of gas, private consumers made good a great portion of the deficiency. Contracts for coal were made at 5s. per ton advance on the previous year's prices. The Directors had been able to combat the large increase in the cost of coal and wages without advancing the price of gas. The Board recommend a dividend for the past half year at the statutory rate of 9 per cent. per annum. The expenditure was £20,219. Sales of gas realized £17,374, residual products £7808, and the profit for the year was £6194.

MISCELLANEOUS NEWS.

ELLESMERE PORT GAS ARBITRATION.

Fourth Day (*continued*).

A report appeared in last week's "JOURNAL" [p. 212] of the case for the claimants in the arbitration between the Ellesmere Port and Whitby Urban District Council and the Shropshire Union Railways and Canal Company, to determine the price to be paid by the Council for the Company's gas undertaking. Subsequent proceedings at the Surveyors' Institution, Great George Street, S.W., are now reported. The Arbitrator was Mr. A. J. RAM, K.C.

Mr. HONORATUS LLOYD, K.C., and Mr. A. M. PADDON (instructed by Messrs. Potts, Potts, and Gardner) appeared for the Shropshire Union Company; and Mr. W. E. TYLDESLEY JONES (instructed by Messrs. Baker and Sons), for the Ellesmere Port Council.

THE CASE FOR THE COUNCIL.

Mr. TYLDESLEY JONES, before proceeding to call evidence for the Council, addressed the Arbitrator. He said the claim was for a total sum of £54,891. This claim was put forward in respect of an undertaking which Mr. Woodall had valued on a constructional basis—that was to say, not merely the present value, allowing for depreciation, but what it would cost to construct the undertaking new at pre-war prices—at £14,635. His total value was £16,540; but this included a sum of £1845 for services, lamps, and meters on the Company's premises which it was admitted were not included in the present sale. To construct this undertaking before the war at normal prices would have cost £14,695; and the Council were being asked to pay for it the sum of £54,891. When such a claim was put forward, it was but natural that those who were acting on behalf of the Council should view the matter with some alarm, and try to bring out all the facts. He fully agreed that there were special features in the case which differentiated it from the ordinary class of arbitrations. Generally it was a question of an undertaking which was being bought out and out as a single entity, where the whole property of the Company was being sold and purchased, and where one proceeded upon certain well-known principles to arrive at the value of the business undertaking which was being transferred. What was done was to take the revenue-earning capacity of the thing which was being sold, and capitalize this; and the purchaser accordingly paid to the vendor the fair value of that which he was taking from the vendor, and which, ordinarily speaking, he was getting. One remarkable feature of the present case was that the Arbitrator was being asked to arrive at a sum which the Council were to pay for the undertaking included in the present sale by capitalizing a profit of nearly £400, which, in fact, had never been made, but which the vendors said they ought to be treated as making out of the undertaking; and the Arbitrator was to order the Council to pay 22½ years' purchase of this profit of £400. The extraordinary feature of this was that the very day after the sale was completed, the Company would be entitled to put up their own little corrugated iron sheds, and begin supplying themselves again, and earning for themselves their profit, which, in fact, they never had earned, but which they said they were to be treated as earning. In other words, the Arbitrator was to treat them as selling to the Council in this case a revenue of £400, though the Company could to-morrow retain this revenue in their own hands by carrying on a small gas undertaking for themselves and supplying themselves—not taking a single cubic foot of gas from the Council who were purchasing the undertaking. Now, what was the agreement in this case? It was an agreement which was entered into before the war, and it imposed on the Council certain very onerous conditions, which the Company were entitled to exact. But it was an agreement which required very careful consideration, to see exactly what it was the Council were to buy. What the Company agreed to sell, and what the Council agreed to buy, was the gas undertaking carried on under a particular section of the Act as existing at a particular date. What was the undertaking which was carried on under the Act? For this, they must refer to the 1893 Act, section 60. At that date the Company had gas-works for the supply of their own premises, and supplied their own premises from the works: "The Shropshire Union Company may from time to time supply at and near Ellesmere Port gas not required for their own purposes to any local board, any sanitary authority, or to any company or person, and may recover the rents or sums of money from time to time payable in respect of any such supply. Provided always that the Company shall not, by virtue of the powers hereby conferred upon them, be deemed to be a company empowered by Act of Parliament to supply gas within the meaning of section 3 of the Gas and Water Works Facilities Act, 1870." So that for the purposes of this section, they were not to be deemed to be a company empowered by Parliament to supply gas. Notwithstanding that the Company had statutory powers for the supply of gas, this was not to prevent the Board of Trade granting a Provisional Order to somebody else for the supplying of Ellesmere Port. At that date, the Shropshire Union Company were carrying on a gas undertaking for the lighting of their own premises. That was the only legal power which they had prior to 1893 to manufacture and distribute gas. What the Act of 1893 did was to give them an area in which they could supply gas to other people. It was a separate undertaking, supplied from the old gas-works. This was the undertaking which was referred to specifically in clause I. of the agreement to purchase. The Company agreed to sell the undertaking carried on under that section, and the gas mains, fittings, meters, and the works, machinery, and apparatus used in connection with the undertaking. Now, they had certain works and plant which were used partly in connection with the undertaking carried on under the Act of 1893, and partly for their own purposes. The problem that one might have plant, buildings, and machinery used for the purposes of two undertakings, and the purchaser might be liable to pay for a portion of it only, was unfortunately incidental to questions of purchase. It was exactly what was specifically provided for in this agreement. He was bound to pay for the goodwill of the business which he bought, and which the Company sold; but he was not bound to pay for the goodwill of business which the Council did not get, and which the Company could not sell. No statutory company could contract itself out of its statutory powers. The statutory power of sale given to the Company here was the power to sell the part of the undertaking for supplying gas not required for their own purposes. They could not sell—they were not authorized to do so—the right to supply gas required for their own purposes. When one came to consider it, this was, of course, a perfectly reasonable proposition. It was inconceivable that the Company could have ever thought that the Council were going to pay them something over £8000 for a supposed profit from supplying gas to their wharves, leaving them free to give this supply the next day. And, of course, it was not what the agreement said.

The ARBITRATOR: May it not be that, although by section 60 there is a limitation to the power to sell gas not required for their own use, yet, once they have been established as a gas undertaking, the words "agrees to sell the gas-works undertaking carried on by the Company at Ellesmere Port under the powers conferred on the Company" are descriptive only, and they might as well be left out of the section. It would then read: "The Council undertakes and agrees with the Company to purchase, and the Company agrees to sell, the gas-works undertaking of the Company?"

Mr. TYLDESLEY JONES: If you omit the words—"under the powers conferred on the Company by section 60 of the Act of 1893," I agree there is nothing in my point. But the words were put in for a specific purpose. This question goes to the root of a very large part of the claim; and it is so important to my clients that they would desire, if you do not accede to my view, that you should make your award in the form of a special case. They are certainly not prepared to pay the very large sum of £8000, or something of that sort, without seeking to have it established beyond doubt that these words, which were inserted for a definite purpose obviously, which have the limiting effect, in our opinion, for which I am contending, and which do make the agreement a reasonable one, should have their natural and proper meaning.

Mr. HONORATUS LLOYD: Of course, the converse will apply, if you propose to adopt the view of my learned friend.

Mr. TYLDESLEY JONES: Then, we are agreed in asking you, if you will, to state your award in an alternative form.

The ARBITRATOR: I am glad to say that doing so will save me a great amount of responsibility.

Mr. HONORATUS LLOYD: This might have the effect that I should have to claim for the destruction of my works, rendering it impossible for me to furnish my own supply, because you see by the next clause they have to remove the works.

The ARBITRATOR: You have to remove under section 2 the plant included in the purchase. Whether your contention is right or wrong on other points, is not this broad enough for you to say whatever purpose they may be used for, and in whatever proportion for the public or for the Company, if they are used in connection with the undertaking they have to be sold, and if they have to be sold they have to be removed?

Mr. TYLDESLEY JONES: I do not assent to that.

Mr. HONORATUS LLOYD said he would like to submit evidence on the point of what compensation he would be entitled to, if Mr. Tyldesley Jones's contention was upheld. He would lose his works, and be unable to supply gas to the premises.

Mr. TYLDESLEY JONES (resuming his argument) contended that 1913 was not a proper year to take for the accounts. The year 1914 was fairer, as it reflected conditions which would be continued for some time after the war, and some of the results of which would continue for the rest of their lives. As to the public lighting, no man would have assumed, if he were going to buy this undertaking, that the price for public lighting, which was fixed as long ago as 1907, would have remained after 1914 at the same price, if the Local Authority had the right (as they had) to determine the agreement. Therefore he said the price for the gas taken for public lighting was not the price which could be anticipated in the future, but something less.

Fifth Day.

Mr. TYLDESLEY JONES, continuing his argument, remarked that if it was going to be said that the price of 3s. 6d. per 1000 cubic feet for the supply to the public lamps, including the excess gas alleged to have been given, was a reasonable price, and so the Council would never have got a reduction, then it would be material for him to show that the alleged excessive consumption did not rest on any sure basis. The fact of excessive consumption was not admitted by him. Further, he maintained that the price of public lighting would not have remained at 3s. 6d., and that the time for revision had arrived. The agreement provided for 4½ cubic feet of gas per hour; and, of course, if the Company could show that the Council had been burning more, they were entitled to make them pay for it. Even if he were wrong in his contention that the undertaking which the Council had to purchase was that for the supply to the public and not to the Company, he still thought no addition ought to be made to the figures for profit on the gas supplied to the Company. But if an addition were made, he certainly thought it ought not to be what the other side had suggested. Nothing, in fact, had ever been treated as a profit on this undertaking; it would have been taking money out of one pocket and putting it into another. In the matter of repairs, it was common ground between them that the figure charged in 1913, should that year be taken, of 2d. per 1000 cubic feet, was insufficient; and he would call evidence as to what might be regarded as a fair figure. A point had been raised as to what the Company could do with the purchase-money, when they got it. Well, some of the things owned by them were steamers. If they invested money in getting steamers made at the present day, the rate of interest they would earn would leave gas undertakings in the shade from the point of view of a remunerative return.

Mr. HONORATUS LLOYD: Will you give me the address of the people by whom you can get them made? I know of a gas company who would be very glad to have the address at this moment of the shipbuilders you refer to.

Mr. TYLDESLEY JONES: You know that the best gas stock can be

bought now to yield 6 per cent. That, I say, is an indication of the rate of return which gas capital ought to be valued at. Continuing, he said that with regard to the number of years' purchase, there were two things he wished to refer to as bearing on the question of security. The revenue which was being valued here was the revenue derived from a gas undertaking which at present was not subject to any competition. The Council, however, had an Electric Lighting Order, which was granted in 1913; and if the Company had retained the undertaking, this might have been put into force. This was a matter which materially affected the question of the maintainability of the revenue. Further, under the Act of 1914, the Council were given powers to supply gas; and there was no section in the Act which said they were not to supply it in Ellesmere Port until this undertaking was purchased. They were given powers which could come into force at once. No doubt, there was a great deal in the retort which might be made that if they had not agreed to purchase the undertaking they might not have got their powers. When considering the exceptional character of the undertaking—that the Company were not bound to supply, and all that sort of thing—the Arbitrator must bear in mind that Parliament would not have left them undisturbed in this extraordinary position, with powers to supply people when they liked, and to refuse to do so when they chose. Parliament would not have allowed this state of affairs to go on indefinitely. Of course, they did give a proper supply; but what he wished to emphasize was that no importance must be attached to the suggestion that the absence of obligations in some way added to the value of the undertaking, and ought to be considered in the number of years' purchase. So far as an allowance for compulsory purchase was concerned, the Arbitrator was not, of course, debarred from adding anything. The agreement specifically stated that it was to be deemed a compulsory purchase. But he did say that in the circumstances of the case no addition ought to be made. In the valuations put forward for the Company, there was an item for surplus works; but his evidence would be that there was no such surplus. On the question of "severance," claim for compensation, and so on, he was going to suggest that the award should be stated alternatively on this point. If the Arbitrator was entitled to allow the Company compensation for severance, he wanted him to name a specific amount; and if he was not entitled to allow them this compensation, then that the amount was so much.

The ARBITRATOR: If I state my award in the form of a special case, I can see several very fine points that will possibly go up to the House of Lords.

Mr. TYLDESLEY JONES: My proposition to you is that you cannot allow anything extra, either directly or indirectly, for compensation.

Mr. HONORATUS LLOYD: There is an extraordinary thing about the agreement, and that is that, under clause 8, we have a right to put an end to it at any time. I am not sure that we shall not do it. The words are: "Or if the Council shall fail from any cause to complete the purchase within three calendar months from the transfer day"—which they have not done—"then in such case it shall be in the option of the Company to withdraw from this agreement."

Mr. TYLDESLEY JONES: We have under our Act full powers for the supply of gas in this district. We have our gas-works erected, and in a very short time we shall have our mains; and the immediate result of this would be that the Company's undertaking would be competed with at the expense of the rates.

Sixth Day.

EVIDENCE FOR THE DISTRICT COUNCIL.

Mr. *W. B. Keen*, who was the first witness called by Mr. TYLDESLEY JONES, said he had been through the accounts, and had agreed certain tables with Mr. Cash. He had not been able in any way to ascertain what the capital expenditure had been. No doubt, such capital outlay as there had been was treated throughout as a revenue expense of the Railway Company. This made it impossible to draw up a balance-sheet, which was very unfortunate. With regard to the residuals, to a very large extent these were taken by the Company, who fixed their own prices, though he did not suggest that the rates so fixed were not fair market prices. The prices were fixed before, and not for the purposes of, this arbitration. It was only for convenience of departmental figures that they needed to put a price on at all. There was no attempt to arrive at other than a fair figure. In 1914 there was a small falling-off of revenue as compared with 1913. The first-named year, he thought, was the fairer one to take, particularly as it contained about four months of war and eight months of peace. It appeared to him that, averaging these two periods, one would obtain a much sounder view of what the future for a great many years was likely to be, than by taking a year which was entirely pre-war. It was the usual thing for public lighting to be charged at a less price than private consumption; and if the Company had remained in possession, there would have been very great pressure put upon them to reduce the price—pressure which he scarcely thought they would have resisted. Whether the Council had to take the whole or only part of the undertaking, he did not think it right that anything should be added for profit on the gas the Company sold to themselves. There was no security that the Company would take gas in future from the Council; and if they did, no one knew now what they would have to pay for it. Mr. Cash had admitted there was no depreciation written off cookers; and he suggested 7½ per cent. on the reducing value. The effect of this was that one never wrote off the asset at all. Witness would rather have suggested 10 per cent. on the original value. Even if the cookers were nearly new, he did not think this should affect the annual charge. They had been shifted about a good deal. There were 151 of them purchased, and the number of services fixed was 286; so that practically one stove had done duty twice over. This all depreciated the stoves. The amount charged for rates in the accounts was quite insufficient. The amount charged in the accounts for management was also very inadequate. It was inadequate as representing the cost to the Company, and also as representing what would be a proper management charge for such an undertaking. He thought the sum they were now spending amounted to £440 a year. It would clearly not be fair to take 22½ years' purchase for the undertaking. The number of years' purchase must, of course, have some relation to the value of money in the same class of investments; and while he did not express any view as to the number of years' purchase that should be taken, he was very strongly of opinion that the rate of interest on any securities which might be anticipated in the future should be taken as at least 1 per cent. higher than the rates which would have been anticipated in dealing with such matters before the war. The effect of this would be that where before the war 33⅓ years had been taken, one would adopt 25 years; for 25 years, 20 years; and for 20 years, 16⅔ years. It must be many years before there would be a return to anything like normal yields on securities. What the Company asked was to be paid the whole of their capital and 35 or 36 years' purchase for goodwill.

Mr. TYLDESLEY JONES: Is the claim for £1800 which is put forward under the head of "severance," in your opinion, quite reasonable in amount?

Witness: The amount is not reasonable in my view. The very basis on which it is claimed here that this undertaking can be worked at a moderate price, is that men having other duties, and forming a part of a very large staff, can be detached for a part of their time to look after the undertaking. It is one of the incidents of a large staff that you are able to absorb them for other employments. In my view, there is no basis for any claim at all.

Mr. HONORATUS LLOYD (in cross-examination): Now as to whether we should receive anything in respect of profit on the gas we supply to ourselves.

Witness: I have never known a case of a business sold where a claim was put in for loss of the advantages that the proprietor of the business derived apart from his profit earning.

The ARBITRATOR: With regard to the undertaking we have to deal with, the contention of the Council is that, though it is a profit-making concern so far as the sale to the public goes, it is not a profit-making undertaking, or ought not to be so regarded, with reference to the gas consumed by the Company. Have you, then, with regard to the gas so consumed, valued it on any other basis?

Witness: No; I have not, in fact, considered what would be a basis.

Would you agree that if the matter is to be severable in the way Mr. Tyldesley Jones indicated in his argument, and treated as in part a profit-producing company and in part not a profit-producing company, after you had arrived at the proper amount to be given in respect of the profit made, there ought to be some amount arrived at by some method with regard to the sum to be paid to the expropriated person in reference to the remainder?—I quite agree.

Cross-examination resumed: He did not know whether the 7½ per cent. depreciation on diminishing value for stoves, &c., was the system adopted by the Inland Revenue authorities. Of course, the agreement with the Inland Revenue people on the question of depreciation was a compromise arrived at particularly in view of the fact that it had been very difficult to get any depreciation at all; and it was highly probable that it was not, in consequence, put on the most scientific basis. Where there were no profits, he agreed that it was very difficult to say what rent a hypothetical tenant would pay; and this was one of the anomalies of rating law. But he certainly did not think that any rating surveyor or any rating authority would, in rating these gas-works, say they had got to add to the income of the Company the value of the benefit that accrued to them from getting their own gas at cost.

Mr. *William Newbigging* said he had made himself familiar with the agreement under which the arbitration was being held, and with the works of the Company. He inspected the works along with the other two engineers, Mr. Herring and Mr. Lees, who were going to give evidence. Witness had made a structural valuation of the works which was in excess of Mr. Woodall's; but his valuation of the mains was somewhat less. In the total, they agreed very closely. The case the Council were putting forward was that the undertaking which they had to buy was that authorized by section 60 of the Railway Company's Act of 1893—that was, the public supply undertaking and the gas-works, retorts, and things of that kind used in connection with it. It would be possible to remove from the works the proportion of retorts which were applicable to the public supply undertaking. There were certain difficulties which would crop up in the apportionment; but they could all be surmounted. He had valued the public supply undertaking on the basis usually adopted in cases of gas-works purchase. If the Council were right and there were two undertakings, and the Council were entitled to take away the public undertaking and the plant relating to it, leaving the Company with their undertaking and the plant relating to it, then, if they were entitled to compensation for severance, they would be entitled to make a claim for the increased cost of continuing to supply themselves with gas.

After further discussion between the Arbitrator and Counsel as to the construction of the agreement, the proceedings were adjourned.

Seventh Day.

A SETTLEMENT.

When the proceedings were resumed on Monday morning of last week no further evidence on behalf of the Council was called, but negotiations took place between the parties with a view to arriving at a settlement. At the conclusion of the lengthy deliberations,

Mr. HONORATUS LLOYD was able to make the announcement that an agreement had been come to; and this arrangement he asked the Arbitrator to adopt in making his award.

The following are the heads of the agreement.

1.—The Council and the Company admit and agree that the undertaking to be purchased is the public supply undertaking, but without any of the property of the Company on the Company's land; and that the purchase does not prevent the Company supplying gas for their own purposes.
2.—Possession of the property so sold to be given to the Council on the Council handing to the Company a mortgage of the revenue of the gas undertaking and district fund and rates to secure £28,000 and interest at 5 per cent. from May 14, 1915.
3.—The Company to retain all profits of the undertaking to the date of the Council getting possession; all necessary apportionments being made.
4.—Award for £28,000 and payment by the Council of £500 on

account of the Company's costs. The Arbitrator's charges to be paid in equal moieties by the Council and the Company. The mortgage to be for six calendar months, and thereafter until called in by three calendar months' notice. The mortgage, in case of dispute, to be settled by Mr. A. C. B. Webb, of the Chancery Bar, and him failing by Counsel nominated by the Arbitrator.

Mr. HONORATUS LLOYD remarked that the parties had settled in this way what might have remained a controversy for two or three years.

The ARBITRATOR said he was sure of that.

TOTTENHAM LIGHT, HEAT, AND POWER COMPANY.

Half-Yearly Report and Accounts.

In the report to be presented at the half-yearly ordinary general meeting of the Company next Saturday, the Directors state that the accounts for the six months ended Dec. 31 show that, after providing for interest charges, there remains a profit balance of £11,586. Adding the amount brought from the previous half year (£14,680) and deducting £1480, the cost of conversion of Consols into War Loan, the sum available for distribution is £24,787. The advance of 3d. in the price of gas on July 1 last reduced the full statutory dividend payable to 7½ per cent. per annum on the "A" stock and 5⅝ per cent. per annum on the "B" stock; and the Directors recommend the payment of the dividends, together with 5 per cent. per annum on the preference stock, which will together absorb £22,602, and leave £2185 to be carried forward to the next account. The sales of gas show an increase of 4·89 per cent. over those of the corresponding six months of 1914; and there has been an addition of 1687 to the number of consumers and of 7115 to the cooking and heating stoves in use.

The accounts accompanying the report show that the revenue from the sale of gas amounted to £134,122; rental of meters, stoves, &c., and the maintenance of incandescent mantles produced £31,011; residuals yielded £36,892; and the total receipts amounted to £202,317. The principal items of expenditure were: Manufacture, £124,263; distribution, £31,921; management, £6502—the total expenses being £185,718. The balance carried to the net revenue account is £16,626 (included in this item is £27, the balance brought from the electricity revenue account); and the total standing at the credit of this account is £24,787. The statements relating to manufacture show that in the half year 1,346,594,000 cubic feet of gas were made, and 1,171,289,000 cubic feet sold; the total quantity accounted for being 1,192,319,000 cubic feet.

The G. J. Eveson Coal and Coke Company, Limited, of Birmingham, have forwarded one of their wallets for Treasury Notes.

COLOGNE GAS UNDERTAKING.

Annual Report.

The report of the Corporation Gas, Electricity, and Water Works of Cologne for the twelve months ended March 31, 1915, has recently been issued; and we abstract from it the following particulars relating to the gas undertaking.

Both the gas and electricity works were greatly affected by the outbreak of war; but by the end of the period under review, the consumption of gas had attained the same level as in March, 1914. The scarcity of petroleum which ensued from the war caused a large access of new consumers to both the gas and electricity departments. In December, 1914, arrangements were made to let on hire, to consumers having ordinary meters, fittings and appliances for the use of gas—a privilege which had hitherto been confined to the users of prepayment meters. The Corporation took over from April 1, 1914, the gas-works of the suburb of Mulheim, which during the twelve months under review produced 147,167,070 cubic feet of gas.

The gas distributed in the twelve months amounted to 55,284,814 cubic metres [1,952,438,491 cubic feet], which is a reduction of 1·30 per cent. on the output for the preceding twelve months. The previous report—see "JOURNAL," Vol. CXXXII., p. 274—recorded an increase of consumption of 5·32 per cent. The consumption of gas per head of the population amounted to 3471 cubic feet. The Ehrenfeld works manufactured 97·49 per cent. of the total output of gas; the remainder being made at the Kalk works. At the Ehrenfeld works, 64 per cent. of the gas was made in vertical retorts, and the remainder in inclined retorts. The Kalk works has two settings of horizontal retorts. The gas unaccounted for was 4·68 per cent. of the output. The average make of gas per ton of coal was 12,129 cubic feet in the inclined retort-settings, and 14,149 cubic feet in the vertical retorts. There were at the end of the financial year 14,936 public gas-lamps with 17,669 burners. The whole of these burners, with the exception of 28 in fire alarms, were incandescent burners, either upright or inverted. The use of distant lighting devices was extended, and at the end of the year about 9200 public lamps were provided with them—four systems being in use. The total number of gas-meters in use on March 31, 1915, was 64,022, as compared with 54,803 twelve months earlier. Of the meters installed at the end of the financial year, 4539 were prepayment meters. There were 8526 cookers on hire. The number of gas-engines supplied on March 31 last was 432, with an aggregate of 2650-horse power.

The Stockton Rural District Council last Wednesday decided, on the recommendation of a Committee who had had the matter under consideration, not to accede to a request by the Haverton Hill Gas Company for an increase in the payment for street lighting.

Intelligent Anticipation

¶ One of the principal difficulties arising out of the present industrial situation is that of the intelligent anticipation of trade requirements.

¶ The problem, however, must needs be faced; and with the new season fast approaching, the present is not a moment too soon to order DAVIS Cookers—*always safe stock*—for early or forward delivery.

The Davis Gas Stove Co., Ltd.,
The Gas Exhibition Salons,
60, Oxford Street, London, W.

CARDIFF GAS COMPANY'S REPORT.

The Directors of the Cardiff Gas Company, in presenting the statement of accounts for the year 1915, state that an interim dividend of 4½ per cent. per annum on the 4½ per cent. preference stock and 5 per cent. per annum on the consolidated ordinary stock having been paid for the half year ended June 30, they now recommend that a half-year's dividend to Dec. 31 on these stocks be paid at the same rate, less income-tax.

The abnormal industrial situation created by the war was further accentuated during a considerable portion of the past season by great scarcity of coal, accompanied by almost unprecedented prices. Not only has the crisis affected the coal market, but the advancement in prices has extended in every direction, thus causing considerable increase in the cost of production. Thanks to favourable contracts for coal and materials generally, the necessity to raise the price of gas did not become imperative until after Midsummer quarter day, from which date a further charge of 4d. per 1000 cubic feet was made to all consumers. The Directors will at the earliest moment reduce the charge. In the meantime, it is gratifying to report that the demand for gas, notwithstanding the restricted public lighting and drastic limitations in the hours of business, has steadily improved, and a larger sale is recorded than over any similar period. At the request of the Ministry of Munitions a special process to produce toluol and benzol has been brought into operation; and, as every additional cubic foot of gas made is directly to the advantage of munitions production, the increased output may be regarded as eminently satisfactory. Notwithstanding the unusually heavy demand for gas, the Directors have encouraged enlistment; a large proportion of the Company's employees having joined the Colours.

Recognizing the increased cost of living among those still engaged with the Company, the Board have made due provision by granting each employee a special war bonus on his wages. The replacement of obsolete retort-settings was completed during the year. Owing to war conditions, the construction of the new gasholder at Grangetown has been necessarily delayed. The work, however, is in an advanced stage, and it is hoped will be completed very shortly.

The gross receipts were £256,586, including £186,781 from the sale of gas, £25,346 from meter and stove rentals, and £43,255 from residuals. The working cost was £219,481, leaving a profit of £37,105.

No Cause for Cheaper Gas.—Under this heading, the "Daily Mail" says that, with reference to the suggestion of some local authorities that the price of gas should be reduced now that some of the constituents in its manufacture are abstracted for munition purposes, the Minister of Munitions points out that the process offers no attractions to gas companies, who have had to go to much expense in order to put it into operation.

LIGHTING OF RAILWAY TRAINS.

[From the "Engineer."]

In some of the daily papers there is, generally once a week, a column in which engineering subjects are dealt with, or are supposed to be dealt with, in a manner that can be understood by the man-in-the-street. In one such column recently there was an article * which began: "The recent Tyneside railway disaster furnishes still another tragic reminder of the danger of using gas for the purpose of lighting railway carriages," and continued: "Unfortunately, we have had accident after accident in recent years on our railways where the wreckage has been fired, to the unutterable agony of the imprisoned victims of the disaster, by escaping gas. After each of these holocausts there has been the usual official inquiry, and invariably the finding has been the same—namely, to the effect that the fire was caused by, or was augmented by, the escape of gas" The article then proceeds to anticipate that Parliament will take some drastic action in this matter, and decide once and for all absolutely to forbid the use of any gas-lit passenger rolling stock after a certain date. This, it is suggested, could be comparatively easily accomplished just now, seeing that the railways are under Government control, and the Government could assist in making the necessary financial arrangements to enable the change from gas to electricity to be made promptly. Finally, it is stated that it would be excellent, too, if Parliament could insist on the abandonment of wood for railway carriage construction, as metal coaches have repeatedly been proved to be far less liable to be smashed up in a collision or derailment.

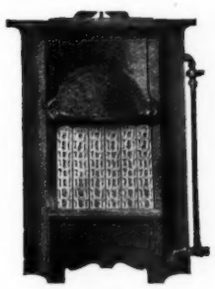
In what we are about to say it must be understood that we have every sympathy with those who have suffered, either in body or mind, from the dangers to which they were exposed in such accidents as the Hawes Junction, Ditton, Aisgill, Quintinshill, and Jarrow, where fire followed the original disaster. But we have yet to be convinced that gas was, in any of these cases, the original cause of the conflagration; and it is even open to some doubt that it augmented any of the fires. Live coal from the fire-box is the more likely cause; and if that be so, the universal provision of electric light as a train illuminant will not prevent future fires. It is true that here are five cases—to which Grantham may be added; but they are spread over a period of ten years, and within that time how many serious wrecks have there been in which there has been no fire? Look at Salisbury (all gas lighted coaches) and Shrewsbury (the majority gas lighted) and, in particular, Weedon last year. We draw particular attention to the Weedon accident as it is not only recent, but was accompanied by the complete destruction of several gas-lighted coaches. The article we have already referred to says that "one can only assume that gas is still used for railway lighting purposes because it is cheaper to install than electricity."

* The article referred to here is the one commented upon in the "JOURNAL" for the 11th ult., p. 74.—ED. J.G.L.

The MAIN D.S.O. Fires

"DEPENDABLE."
(Reduced Type.)

"SYMMETRICAL."
(Reduced Type.)



"ORIGINAL."
(Reduced Type.)

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Were this conjecture so worded as to suggest that the substitution of electricity for gas was delayed because of financial reasons, we would be inclined to agree. We think that, unless our railway directors can justify the expense of changing the system on all existing stock—because that is what is recommended—they would be failing in their duty to the shareholders, for whose property they act as guardians. Were the State to meet this difficulty by making "the necessary financial arrangements" (as is suggested), then it might be said that the State was undertaking an unnecessary work at the expense of the public. In dealing with new stock, it is a different matter. There is then no question of scrapping good material. And when new coaches are built, seeing that many of the public object to gas, the companies will do well to make this concession to their patrons. On most of our leading railways this is the policy pursued; and in the evidence given at the Jarrow Board of Trade inquiry, it will be seen that for the last three years all the new stock on the North-Eastern Railway has been fitted with electric light. It will also there be seen that this Company had under consideration, at the time the war broke out, the substitution of electricity for gas in all the existing stock. It may also be added, as an indication that railway directors do not let expense stand in the way of reform when they are satisfied that a change of policy is necessary, that the London and North-Western Company, as a result of the Ditton accident of September, 1912, ordered that all its gas-lighted stock should be provided with electric light within a period of ten years.

The article deals next with the question of fire-proof vehicles, and concludes as follows: People both speak and write occasionally as if the railway companies were careless about life and limb, and that the Board of Trade was needed to drive them to do their duty. Nothing could be further from the fact. Every accident damages the companies both in pocket and prestige, and if for no higher reasons, they would adopt every reasonable means in their power to reduce accidents to a minimum. We say without fear of contradiction that the splendid reputation of our railway companies has been won by their own effort, and not under the compulsion of a Government Department.

Gas Legislation in New South Wales.—In the course of a report to the Premier of New South Wales, the Under Secretary (Mr. J. B. Holme) says: "The Gas Act, 1912, aimed at giving to the community the benefit of (*a*) gas of the highest quality at the lowest possible charge compatible with reasonable profit, and (*b*) the best possible service of gas; and the results achieved have been substantial. The illuminating and heating quality of the gas now supplied cannot be seriously questioned, and the charges of the supplying companies in the Metropolis are now strictly controlled. The pressure in certain localities is not as satisfactory as it might be; but, generally speaking, it may be said that the consumers of gas are very much better off now that they have departmental protection than they were in the days of unlimited licence on the part of the gas companies."

EXTRACTION OF BENZOL AND TOLUOL.

No Attraction to Gas Undertakings.

At a Meeting of the Westminster City Council last Thursday, the Works Committee reported the receipt of a letter from the Ministry of Munitions, in reply to the Council's suggestion that an allowance should be made by the gas undertakings in respect of the extraction of benzol and toluol from gas.

The letter pointed out that the process in question offers no attractions to gas undertakings; and unless the experience of those concerns over which the Council have testing powers has been the reverse of that of almost all other undertakings, they have been put to a considerable voluntary out-of-pocket expenditure in order to put it into operation, in addition to the permanent cost of working. It was also pointed out that the previous circular which was issued by the Board had the unfortunate effect that it was bound to produce an exaggerated impression of the possible injustice to gas consumers. Incandescent burners depend on the calorific value of the gas; and flat-flame burners are now so few that probably less than 3 per cent. of the total make of gas in this country is used for its illuminating value. Yet a small lowering of this standard which the majority of undertakings are legally bound to maintain, by the process of the extraction of toluol, was the reason for the issue of the circular. The all-important calorific power is affected to a comparatively trifling extent.

In the above circumstances, the Committee stated that it is inadvisable to pursue the suggestion that undertakings should be required to make an allowance in respect of any deterioration of the lighting or heating qualities of gas consequent on the extract of benzol and toluol.

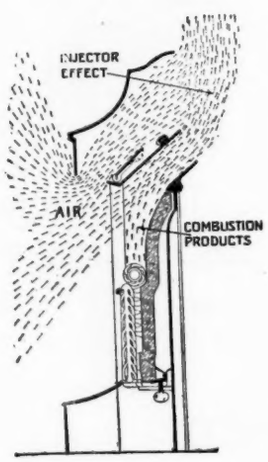
LIVERPOOL'S FIRST GAS SUPPLY.

[From the "Liverpool Courier" of Monday, Jan. 24].

Gas lighting in Liverpool has now been in operation for a hundred years. To-day marks the centenary of the system here. Some interesting facts relating to the subject were incidentally touched upon in a lecture recently given before a Liverpool Society by Mr. James M. Dow, on "Old Liverpool;" and these are very *apropos* to-day.

The idea of establishing a public gas supply for Liverpool, it appears, was started at a meeting held in the "Crown Inn," Redcross Street, on the 16th of October, 1815—a local tradesman, Mr. Varty, of Dale Street, being especially interested in the system. The outcome was the lighting of the first public gas-lamp, opposite to the Town Hall, on the 23rd of January, 1816; the supply being obtained from a small apparatus on the premises of Mr. Varty.

WHAT "THE LANCET" (JAN. 15, 1916) SAYS OF WRIGHT'S "INJECTOR-VENTILATING" GAS-FIRES



"In the earlier days of the gas-fire the system fell into disrepute on three counts: first, the combustion products did not entirely escape up the flue, but vitiated the air of the room to some extent; secondly, even when that was not the case there was no efficient ventilation of the room as there is with the open coal fire; and thirdly, the flames were irritatingly noisy. Until quite recently we have not examined a gas-fire which quite satisfied us on all three points. Messrs. John Wright and Co., of Essex Works, Birmingham, have introduced an 'injector-ventilating' gas-fire which shows that these essentials have received considerable attention, and the result is a very important gain to this system of heating by radiant gas-fires. This fire not only secures the complete withdrawal of the products of combustion, but by means of a second opening a powerful in-draught of air from the room is induced to flow up the chimney. This ventilates the room as effectively as the open coal fire, and a true atmospheric flame is secured which is constant in its character and unaffected by variations of pressure; above all it is silent. It is surprising to see a clean blue intense flame free from purring sound. This has been effected by bringing about a thorough mixing of air and gas by means of a perforated thimble dropped into the opening of the burner. This is provided with vertical perforations, and in ordinary practice it cannot be choked with grit. The purring is probably due to a rapid series of minute explosions resulting from an imperfect mixture of gas and air. At the same time there is an ingenious fitting which provides for initial pressure adjustment. Altogether, this fire marks a most important advance, and is calculated to remove what prejudices remain against the use of gas for the purpose of domestic heating."

JOHN WRIGHT & CO., ESSEX WORKS, BIRMINGHAM.

As in all important innovations affecting material progress, the beginning of the gas erain Liverpool caused both curiosity and perplexity. The public did not quite know what to make of it. Some, we are told, touched the pipe conveying the gas, to see whether the pipe was hot; while insurance directors were alarmed lest the use of gas would cause fires. Whatever prejudice may have existed, soon however disappeared.

On the site of this first local gas-lamp, and known as the High Cross, there had been established in 1651 one of the two public lanterns which were lighted in periods of dark moon. The other lantern stood on the White Cross, the site of which is now the entrance of Exchange Buildings—Old Hall Street end.

From these early beginnings and a somewhat primitive method, what an enormous development has taken place! Liverpool may now be said to be one of the best-lighted cities in the kingdom; and while due recognition is allowed for the great scope of the electrical illuminant, yet immense progress in gas lighting has been made. At present there are over 25,000 public gas-lamps in Liverpool, fed by 930 miles of gas-mains. The bodies first concerned with lighting were the Liverpool Gaslight Company, constituted by an Act of Parliament passed May 23, 1818, and a Company which was formed in 1822 for the production of gas from oil. These Companies amalgamated in 1848, hence the former title, Liverpool United Gaslight Company. From the inception of the original Gas Company to 1849 their offices were in Dale Street. In 1854 the premises were sold to the Corporation, and the present police offices stand on the site.

ITALY AND RUINOUS FREIGHTS.

In a letter appearing in the "Times" last Wednesday, Mr. George A. Touche, M.P., wrote as follows on the subject of Italy and ruinous freights:—

> "As a Director of an important French Gas Company, which has to export about 360,000 tons of coal annually to Genoa, I have had an unfortunate experience of the serious consequences of the rise in freights. These have increased from a pre-war rate of 8s. a ton to 90s. a ton. The commercial results of such exorbitant rates are disastrous; but the position has a much wider significance than the prosperity or injury of an important French industrial company, whose securities are held in this country and in France. The situation is fast becoming perilous from a political point of view. Gas is used for domestic purposes in thousands of homes in the chief cities of Italy. If its price is increased in proportion to the increase in the price of coal, and consequently in manufacturing cost, its use will be almost prohibitive. I have before me a letter from Italy which speaks in grave language of the effect on the Italian community of the enormous freights now demanded and obtained by shipowners for the conveyance of coal to Italy, and on Italian traders of the rate of exchange, which is now 32 lire for the pound sterling. Powerful influences are at work to foment discontent and ill-feeling, and to encourage a conviction among the Italian public that it would be better to return to the German alliance. To those who know something of the extent of Germany's financial penetration of industrial Italy before the war, the danger of the present situation will be obvious. The British Embassy is credited with knowing the situation on paper; but there is an impression that it possesses only a limited knowledge of the ideas and feelings of the mass of Italian traders and consumers. The activities of various Government Departments have not yet succeeded in producing any palliative for a commercial and economic situation between England and Italy which is becoming intolerable. The root of the evil appears to lie in a mishandling of the shipping problem, created by the shortage of tonnage. It is alleged and denied that there has been a wasteful use of ships in Government employment. One thing is clear: Present methods have failed, and we are heading for political as well as commercial disaster."

It may be remembered that when presiding, in the absence oft he Chairman and Deputy-Chairman, over the meeting at the end of last year of the Continental Union Gas Company, Limited, Mr. Touche had a good deal to say on this subject, as reported in the "JOURNAL" for Dec. 21, p. 653.

GAS COMPANIES' POWERS IN QUEENSLAND.

A Bill to Limit Profits.

In the Legislative Assembly at Brisbane, early in December, Mr. Huxham (the Assistant Home Secretary) moved the second reading of a Gas Bill having for its objects: (1) To create a standard of illumination, heating power, and purity of the gas; (2) to provide for the testing of meters; (3) to make the installation of meters compulsory; (4) to regulate the price of gas.

In explaining the need for the measure, the Minister said that the profits of gas companies in Queensland had been exceedingly large; while many of the companies had increased their capital out of reserves. Even then large dividends had been declared. The Bill would, however, have the effect of limiting profits by providing a standard price and a standard purity. The companies had made enough money out of the public in the supply of poor gas at a high price; and it was time they were controlled. It was high time that the Government safeguarded the interests of the people, so that they should be given better gas at a cheaper price. This was no novelty. It should have been in existence many years ago, and it merely remained now for the Government to put it in operation as a duty to the public. The New South

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Wales Government had grappled with the gas monopolies, and even regulated their dividends by limiting them to 10 per cent. The result was, therefore, greatly beneficial to the people, who were able to obtain their gas at a considerably reduced price. The profits of the Wynnum Gas Company had been limited by a former Government, and all that remained to be done now was to extend this principle. The mains of the South Brisbane Gas Company had been almost renewed of late years, and yet they had maintained their high rates of profit. They had seen, too, that the Company had been extended to certain districts; but because the residents would not pay 10s. per 1000 cubic feet, the Company would not use the pipes. These extensions had cost upwards of £20,000; but no gas had passed through the pipes until the people agreed to pay the huge price demanded. Did this not merit interference? The community using the service in other districts had to bear this loss; but the Company saw to it that their dividends were maintained. They could not tolerate such a state of affairs any longer. The gas legislation in New South Wales had had most encouraging results. The Bill was not quite what he desired, but it was a step in the right direction; and the dog-in-the-manger attitude of the South Brisbane Gas Company in connection with the incidents at Sherwood and Yeronga would be stamped out. The measure would come into operation on Jan. 1.

NOTES FROM SCOTLAND.

Edinburgh Streets and Automatic Lighting.—It was reported in last week's "Notes" that, acting in conformity with the requirements of the Military authorities, it had been decided to make no change in the existing regulations as to the public lighting of Edinburgh. At a meeting of the Cleaning and Lighting Committee of the Town Council, however, held on the 24th ult., the question of automatically lighting and extinguishing the lamps was considered, and it was resolved to ask Messrs. Alder and Mackay, of Edinburgh, to fit up an experimental installation. If the experiment proves successful, it may lead to the adoption of the system throughout the city. There is a strong feeling that something should be done to remove the inconvenience, not to say danger, caused by many of the streets being in darkness; and the Committee are hopeful that the apparatus will afford the means of doing this. It was stated at the meeting that at Newcastle, Leeds, Ipswich, Bonnyrigg, and Haddington the method was in successful operation.

Coatbridge Gas Company.—An extraordinary general meeting of the shareholders of this Company will be held next Tuesday to authorize the raising of additional capital to meet the expenditure on the proposed introduction of modern carbonizing plant. Previous to that, however, the ordinary meeting will take place, when the Directors will submit the statement of accounts and balance-sheet for the year ended Dec. 31 last. The consumption of gas amounted to 235,714,057 cubic feet—being an increase of 957,140 cubic feet over the previous year. The gross revenue for gas, residual products, &c., was £45,854. Owing to the increased return from residual products, the Directors were able to reduce the price of gas by 3d. per 1000 cubic feet as from Jan. 1. They recommend dividends (in accordance with the sliding-scale) at the rate of £10 15s. per cent. per annum on the original stock, and of £7 10s. 6d. per cent. per annum on the three issues of £10 shares, less income-tax. The report mentions the sudden and lamented death of ex-Provost Sharp, the late Chairman of the Company, in August last, and states that the vacancy on the Board was filled by appointing Mr. Alexander Neilson, of the Dundyvan Iron-Works—Mr. Alexander S. Legat being appointed Chairman.

Perth Gas Difficulties.—Referring to the troubles at the Perth Gas-Works, of which notice has already been taken, the "Dundee Advertiser" states that in municipal circles it is realized that recent recurring shortages of the gas supply and complaints as to its unsatisfactory character are less serious than the financial questions involved in effecting improvements in the supply. The revenue account shows that the current year began with a deficiency of £371. That considerable outlays on the plant at the gas-works will shortly have to be made is, it is added, certain. "Though authority has been granted to borrow from the bank up to £10,000, it is clear that, even if only the half of this sum should be required, the interest on which may safely be taken as at 6½ per cent., it would amount to no less than £325 per annum. When it is considered that the capital account of the gas undertaking is represented by annuities, loans, stock, and bonds, amounting in all to £259,294, and the total revenue for last year, including £1465 from the burgh general assessment for public lighting, was £45,680, of which £13,368 was carried to the net revenue account for payment of annuitants, sinking fund, interest, &c., it will be understood that the financial problems involved in any alteration or reconstruction of the gas-works are such as will tax the abilities of the Town Council to the utmost to place them on a satisfactory footing."

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 31.

Tar products generally remain without change, and there is nothing of special interest to report. To-day's values are: Pitch, 19s. to 19s. 6d. per ton, in bulk; creosote, 4¼d. to 4½d. per gallon, in bulk; 90/160 solvent naphtha, 2s. 2d. to 2s. 3d. per gallon, naked—all at makers' works, net cash.

The price of 25 per cent. sulphate of ammonia remains unaltered at £17 5s. per ton net, into buyers' bags, at makers' works. A fair amount of business is being done.

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Tar Products in the Provinces.

Jan. 31.

There has been practically no change in the market for tar products during the past week. As regards pitch, this article is still dull through want of getting tonnage in which to remove it, and in most cases prices are purely nominal. Creosote is dull and difficult to dispose of, as most of the works are beginning to be somewhat hampered by their stocks of it. Naphthas are in very good demand, though prices show a tendency to advance.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 3d. to 22s. 3d. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10$\frac{3}{4}$d. to 11$\frac{1}{4}$d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6$\frac{3}{4}$d. to 7d. Solvent naphtha, naked, North, 2s. 1$\frac{1}{2}$d. to 2s. 2$\frac{1}{2}$d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2$\frac{5}{8}$d. to 2$\frac{7}{8}$d. Heavy oils, in bulk, 3$\frac{1}{8}$d. to 4$\frac{1}{2}$d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, pure, £20 to £30; creosote salts, 90s., bags included. Anthracene, "A" quality, 2d. to 2$\frac{1}{2}$d. per unit; "B" quality, nominally $\frac{3}{4}$d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Jan.* 29.

In consequence of the further restrictions placed on the export of this material to foreign countries by the Board of Trade and the Board of Agriculture, the tone of the market has been depressed during the past week, and prices have been more or less nominal. The closing quotations are £17 10s. per ton f.o.b. Hull, £17 12s. 6d. f.o.b. Liverpool, and £17 15s. f.o.b. Leith. In the forward position, no fresh transactions have transpired, although there would be buyers abroad for February, March, and April shipment if it were possible to execute the orders in this country.

Manchester Tar Prices.

The average price realized for tar—based on the value of the products—for December deliveries, throughout the Manchester district, was 23s. 9d.

Nitrate of Soda.

This market has advanced still further, and the values on spot are now 16s. 9d. per cwt. for ordinary quality, and 17s. 9d. for refined.

Sulphate of Ammonia.

From another source, it is stated that there has been practically no change in this article during the past week, and prices remain as before. Outside London, makes are quoted at £17; Hull, £17 15s.; Liverpool, £17 17s. 6d.; Leith, £17 17s. 6d. to £18; Middlesbrough, £17 15s. to £17 17s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The briskness in the northern coal trade continues, and prices are firm, with an upward tendency in some cases. The shipments appear to be good; but these are largely on contract. For new orders, the prices are higher. In the steam coal trade, the strong position makes advances needful to be given when early loading is desired. Best Northumbrian steams are quoted from 25s. to 29s. per ton f.o.b., according to time of delivery; second-class steams are scarce at 23s. to 23s. 6d. per ton; and steam smalls are firm at 12s. 6d. to 15s. per ton f.o.b. The output is fair under the circumstances of the limited number of miners. In the gas coal trade, the quotations are a little higher—possibly because the margin of coal free for sale is now small, and there are Government needs in the market. Best Durham gas coals are 24s. per ton f.o.b.; second-class gas coals are 22s. per ton; and "Wear Specials" are firm at 24s. 6d. to 25s. per ton. The exports are steady, and there are fair shipments on account of the long contracts. It is said that Italian buyers are holding back, because of the high cost of coal and high freights. As much as 87s. is quoted for freight on gas coal, Tyne to Genoa; and the rate to London is near 15s. The delivered cost of the coal is therefore very great—to Italy especially—and even at these high figures, supplies cannot be considered full. Contracts are only slowly negotiated just now; the Government's purchases being full, both of steam and best gas coal, and the extent forward of such purchases is not easily foreseen. Coke is steady, with fair exports; but the production is heavy. Good gas coke is quoted from 27s. 6d. to 29s. f.o.b. in the Tyne, according to class. Home requirements of gas coke are steady.

Mansfield Coke Prices.—At last Friday's meeting of the Mansfield Town Council, Mr. Beazley inquired whether the price of coke had been fixed by the Gas Committee to purchasers outside the borough, and what it would be when the advance took place. The Mayor (Mr. T. Smith), who is also Chairman of the Gas Committee, said this was a question which it was impossible to answer. The Committee did not sell to anybody outside the town until Mansfield buyers had been supplied. There had been times when they could have obtained a far higher price outside than in Mansfield itself. At present, the Committee had one contract at 16s. 3d. a ton—much more than they obtained locally. It would pay them now to cut off Mansfield supplies altogether. They had been in a position to get close on 30s. a ton from outsiders.

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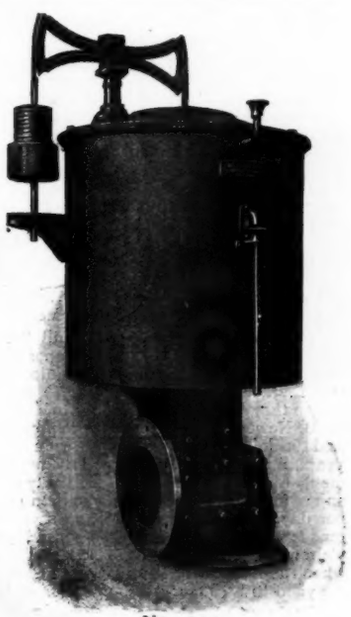

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An Old Bradford Holder.

The seventy-year-old gasholder which is being dismantled at the Bradford Corporation Thornton Road gas-works [to which reference was made last week in our report of the Yorkshire Junior Gas Association meeting] has created considerable public interest locally, since the visit of the Yorkshire "juniors" called attention to the affair. Though its design is now completely obsolete, it was in its time probably one of the largest holders in the country. It had a capacity of between 80,000 and 100,000 cubic feet, as against a capacity of 700,000 cubic feet of the newer holders alongside of it. The dismantling has disclosed, in addition to the peculiar wooden umbrella-like strutting, the exceptionally fine quality of the metal outer plates, which were made of local Bowling iron, the best obtainable at the time. In the days of the erection of the holder, the gas was sold at about 5s. per 1000 cubic feet, as against Bradford's normal price of modern times of 2s. 1d.—though it is up, owing to war exigencies, to 2s. 6d. The holder was built in 1846; but gas had been used in Bradford 23 years before, having been made in a brick oven, before the time of the iron retorts. In those days, the charges were 25s. per burner per year; the lights to be extinguished at 9 p.m. In 1827, the consumers were paying 13s. per 1000 cubic feet.

Guiseley Water-Works Purchase Question.—The Guiseley District Council have been in committee to hear a report by a deputation who interviewed the Guiseley Water Company with a view to the purchase of the undertaking by the Council. It is understood that, as a result of the meeting in committee, the Council decided to purchase, subject to the approval of a general meeting of the shareholders and of the Local Government Board.

Durham City Gas Company.—The annual report of the Company, issued last week, shows that, after deducting the interim dividends for the half year ended last June, there is an available balance of £3382. The amount required to pay the ordinary dividend (less tax) is £2420. This leaves a net balance to carry forward of £961, which the Directors consider very satisfactory in view of the existing state of things. A dividend of 5 per cent. on the original and 3½ per cent. on the additional capital is proposed for the half year; making 10 per cent. and 7 per cent. respectively for the year.

Gas and Electricity Works Joint Management.—A lengthy discussion took place at a special meeting of the Abertillery Urban District Council, on a suggestion that the electricity undertaking should be under the control of the Manager of the gas-works (Mr. E. D. Wootton); Mr. Dan Lloyd, who had been in charge of the electricity works since they started, having accepted another appointment. For some years there has been a feeling that it would be a good thing if both undertakings were under one management; and it was thought that the resignation of Mr. Lloyd afforded an opportunity to give a trial to the proposal. It was stated that both undertakings would have to be kept financially independent of each other to comply with the requirements of the Board of Trade, &c. The Council decided to make a six months' trial of the proposal for joint management; and this will involve also the merging of the Electricity Committee into the Gas Committee.

Economizing at Llandudno.—At the monthly meeting of the Llandudno Urban District Council, Mr. Pierce Jones moved that all the street-lamps should be lit which could be lit without a breach of the regulations under the Defence of the Realm Act. Mr. David Davies seconded, submitting that in using gas they were complying with the wishes of the Munitions Department by increasing the supply of residuals for the manufacture of high explosives. Mr. W. Thomas, the Chairman of the Gas Committee, said they were complying as well as they could with the request of the Prime Minister to be as economical as possible of the gas-lamps in the town. Of these, 120 were lit and 340 were not lit; and at the end of the financial year he hoped they would have saved £238 in the public lighting. At the same time, wherever a lamp seemed necessary for the public safety it was lit, and the people generally were getting accustomed to the dim lighting of the streets. The motion was defeated by a large majority.

Hull Water Supply.—The Hull Water and Gas Committee will consider at a special meeting a proposal that no further increase in the number of outside taps should be allowed, and that as existing taps of this character become worn out, they should not be renewed except where they form the sole supply to houses. The Water Engineer (Mr. C. B. Newton) points out that the present population is about 300,000, and the daily consumption of water 12 million gallons. In about fifteen years, the population will probably increase to 400,000, and the requirements to 16 million gallons. In thirty years, the population will reach approximately 500,000, and 20 million gallons of water will be required per day. From these figures, he says, it will be seen that great demands will be made upon the source of supply. The average daily yield of the existing works in 1914 amounted to 11 million gallons; and when the Dunswell Station is completed, they might reasonably expect the yield to be increased to approximately 15 million gallons.

Lighting of Paignton.—The question of the lighting of the town was considered by the Paignton District Council at a special meeting yesterday week. By a rigid interpretation of the orders of the military authorities, stimulated by a desire for economy, the Council have for some time past ceased to light any of the public lamps. Mr. Vanstone, who had protested on several occasions against this policy as detrimental to the public interests, suggested that in the centre of the town every alternate lamp should be lighted from lighting-up time in the evening until 9.30 p.m.; and that controllers should be fixed to the lamps so that men would not be required to light and extinguish them. Mr. Smith proposed that consideration of the matter be deferred until August, when the estimates for the winter lighting would be considered. Mr. Ham pointed out that the Council were heavily in debt, and had no lighting rate; and the proposal would involve a capital cost of £300 or £400 to begin with. He did not agree that harm was being done to Paignton as a resort by the absence of light. The Council decided to hold another meeting in committee to consider the matter further and decide on a course of action.

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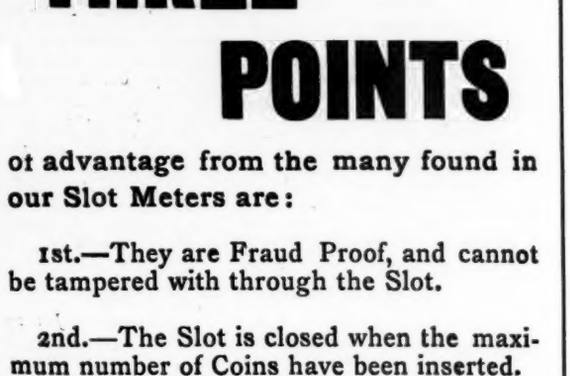

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STOCK MARKET REPORT.

THE volume of business on the Stock Exchange last week underwent a considerable contraction, and the tone was somewhat languid and dull; but there was nothing to cause any feeling of anxiety or depression. Market movements are often fitful, and responsive to esoteric influences which are not far-reaching. In Government issues, the War Loan and Consols remained steady until towards the close. Home Rails were rather irregular, although the dividend announcements came fairly up to general expectations. The American Market was very dull; and Canadian Pacifics were dragged down, though the Company is doing fine business. In Foreign, the French loan has been going strong, with a brief interval of profit-snatching. Japanese continued in demand. Argentines revived; but South Africans moved irregularly. In the Miscellaneous group, rubber had a wholesome steadying, but textiles, armaments, copper, and oil were in good request. Among topics of the week, the Chancellor of the Exchequer announced that the 4½ per cent. War Loan scrip and the 5 per cent. Exchequer Bonds will be accepted at face value from subscribers to the next War Loan of long date. At some bank general meetings, the chairmen dwelt on the advisability of fixing a limit to the rate of income-tax on this loan. This would probably attract many foreign subscribers. In response to a Stock Exchange petition numerously signed, the Treasury have removed the minimum prices attached to certain securities. The continued fall in value of the German mark is alarming Berlin circles, and their financial quacks are busy devising nostrums to act as a tonic upon the debilitated exchange. One has heard before now of "Pills against the Earthquake." The question of excluding alien enemy members from the House is becoming more acute, but its legal bearings require consideration. Business in the Gas Market improved both in volume and in tone. On Monday, a bid of 75 for Gas Light ordinary was made; but there was no stock or no seller. Next day, 77½ was given for it. On the removal of the minimum price, Melbourne debenture (the only quoted gas issue which had been "minimized") was promptly done at 91. The Money Market was easier.

Bargains done for cash during the week were as follows: On Monday, Bombay 4⅞, Commercial debentures 55, Imperial Continental 70, 70½, 71¼, 72, Monte Video 8⅜, 8½, South Metropolitan 77, 77⅛, 77⅜, 77¾, 78, 78⅛. On Tuesday, Gas Light ordinary 74¾, 75⅛, 75⅜, 77½, ditto preference 76⅛, Primitiva 2⅛, 2 3/16, South Metropolitan 77⅜, 78. On Wednesday, Buenos Ayres 70⅞, 71¼, Brentford debenture, 74, 74⅛, Gas Light ordinary 75⅛, 75⅜, ditto preference 75¾, ditto debenture 60½, 61, Imperial Continental 70, 70⅜, Primitiva preference £3 10s., South Metropolitan 78, Tottenham "A" 124½, 125. On Thursday, Alliance and Dublin 68, Gas Light ordinary 75⅛, 75⅜, 75⅝, 76, ditto debenture 60⅜, 61, Imperial Continental 69¾, 70, 70⅛, 70½, 70⅜, Monte Video 8⅜, Newcastle 81, Primitiva preference £3 11s. 3d., £3 12s., £3 12s. 3d., £3 12s. 6d., South Metropolitan 78. On Friday, British debenture 69, Commercial 4 per cent. 75, 75⅛, European 12⅛, Gas Light ordinary 75⅛, 75⅜, ditto preference 75⅛, 76⅛, Imperial Continental 70⅛, South Suburban 84½, 85. On Saturday, Gas Light maximum 60, 60½, Melbourne 91, Primitiva preference £3 13s. 9d., South Metropolitan 77⅜.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	68
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5¼—6⅜	5 17 8	4⅜
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water: 10 p.c.	29—30	5 6 8	..
873,480	10	,,	7	7/-	Bournemouth Gas and Water: B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	4 5 9	..
147,240	—	—	—	4	Bournemouth Gas and Water: Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 8	..
880,000	,,	,,	†11	55/-	Do. New	204—209	5 5 8	..
50,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	74—74½
217,380	Stk.	Feb. 26	11	10⅔	Brighton & Hove Orig.	208—218	5 8 4	..
244,200	,,	,,	8	7⅔	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	69
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	70⅞—71½
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,518,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	75—75½
560,000	,,	,,	5¼	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	55
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	12⅞
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke: 4 p.c. Ord.	98—102	4 15 6	74⅜—77½
2,600,000	,,	,,	3½	3½	Gas Light and Coke: 3½ p.c. max.	76—79	4 8 7	60—60½
4,062,235	,,	,,	4	4	Gas Light and Coke: 4 p.c. Con. Pref.	96—99	4 0 10	75½—76½
4,674,850	,,	June 11	3	3	Gas Light and Coke: 3 p.c. Con. Deb.	72½—74½	4 0 6	60½—61
180,000	,,	,,	10	10	Gas Light and Coke: 10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16⅞	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7¼	7⅜	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜	6½	Do. B	115—119	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	69½—72
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,342	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	,,	,,	7		Liverpool 5 p.c. Ord. B	146—148	4 14 7	..
806,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	8 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	91
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	8⅜—8½
1,775,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	81
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—88	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅜	North Middlesex 7 p.c.	14—16	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅞	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5⅛—6	6 18 4	2⅛—2 3/16
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4⅞—5	5 0 0	3/10/0—3/12/0
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo: 6 p.c. Pref.	10¼—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo: 5 p.c. Deb.	4⅞—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	233—234	4 9 3	..
209,984	,,	,,	10	10	Do. B	222—224	4 9 3	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4,0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	77—78½
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	84½—85
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
137,058	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District: A 5 p.c.	135—138	5 8 8	124½—125
742,275	,,	,,	6	6	Tottenham District: B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4	Tottenham District: 4 p.c. Deb.	87—89	4 9 11	..
189,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—Wandsworth A 5 p.c.	151—156	5 7 4	..
80,000	Stk.	Feb. 26	8⅜	78/9	,, B 3½ p.c.	129—134	5 2 7	..
255,636	,,	,,	6⅞	63/9	,, C 3½ p.c.	110—115	5 2 0	..
108,075	,,	,,	5/17/8	55/1½	Wimbledon 5 p.c.	117—122	5 0 5	..
852,000	,,	,,	6½	57/6	Epsom 5 p.c.	121—126	5 5 2	..
98,000	,,	,,	6⅜	63/9	3 p.c. Deb. Stk.	66—69	4 6 11	..
88,416	,,	June 26	3	3				

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINEER AND MANAGER. Sittingbourne Gas Company. Applications by Feb. 12.
CHIEF SALESMAN. Alliance and Dublin Gas Company. Applications by Feb. 7.
CLERK. Redditch Gas-Works.
MAIN AND SERVICE LAYERS. Aberdare Gas-Works.
UNDER WORKS FOREMAN. No. 6147.

Appointments Wanted.

ENGINEER AND MANAGER, WORKING MANAGER, &c. No. 6139.
ENGINEER OR REPRESENTATIVE (Gas, Water, and Electric). No. 6149.
REPRESENTATIVE. No. 6148.

Plant, &c. (Second Hand), for Sale.

REMINGTON TYPEWRITER. Multo, Northampton.
STATION METER, HYDRAULIC MAIN, FURNACE FRAME, RETORT, &c. Dunmow Gas-Works.

Plant, &c. (Second Hand), Wanted.

TOWER SCRUBBER, STATION METER &c. No. 6150.

Meetings.

BRENTFORD GAS COMPANY. St. Ermin's Hotel. Feb. 11. 2.30 o'clock.

Patent Licence.

GAS WATER HEATER. Heron Rogers and Dehn, Broad Sanctuary Chambers, Westminster.

TENDERS FOR

Coal.

ABERTILLERY GAS-WORKS.
MILFORD HAVEN URBAN DISTRICT COUNCIL. Tenders by Feb. 12.

Cookers.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 8.

Fire-Clay Goods.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 8.

General Stores (Brass Goods, Oil, Lime, Lead Pipe, Ironmongery, Sulphuric Acid).

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 8.
WIGAN GAS DEPARTMENT. Tenders by Feb. 12.

Meters.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 8.

Oxide of Iron (Spent).

KIRKINTILLOCH GAS-WORKS.

Pipes.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 8.
WIGAN GAS DEPARTMENT. Tenders by Feb. 12.

Tar.

ABERTILLERY GAS-WORKS.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

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Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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THE very best Patent Grids for Holding Oxide Lightly.
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A. P. GHENT,
Sittingbourne, Jan. 27, 1916. Secretary.

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